# PEOPLE INTERACTION IN KOSHI WILD LIFE CONSERVATION AREA *(KOSHI TAPPU)*

*THESIS*

***Submitted for the degree of***

*DOCTOR OF PHILOSOPHY IN SCIENCE*

**2002**

By

***Hari Prasad Thapaliya***

Department of Zoology

***University of Allahabad,***

**Allahabad. (India)**

# *Bubalus bubalis*

A female wild water buffalo in the grazing side of reserve

*April 21, 2000 (Photo: Hari Thapaliya)*

f. S. C. Tiwari
M Sc ,D.Phil , FESI

Department of Zoology
University of Allahabad, Allahabad
☎ : 501373 (R), 460788 (O)

To

Date ... . . .... ... . ..... ...

# CERTIFICATE

*This is to certify that the thesis entitled,* ***"People Interaction In Koshi Wild Life Conservation Area (Koshi Tappu)"*** *submitted by* ***Mr. Hari Prasad Thapaliya,*** *for the degree of* ***Doctor of Philosophy*** *to the Department of* ***Zoology, University of Allahabad, Allahabad,*** *is record of bonafide research carried out under my supervision. It is further certified that all the data given in the thesis are his own observations and no portion there of has been submitted for any other degree. H. P. Thapalia attended the University for more than twenty four months and completed his experimental work during this period.*

Date : 2.9.2002

Place : Allahabad

(S. C. Tiwari)
Supervisor
Department of Zoology
University of Allahabad
Allahabad

Residence : 28-B / 76-D, Allahapur, Allahabad

*I must record my thanks to my colleagues* **Puspa Raj Joshi, Ramjee Ghimire** *and others good wishers for their kind co-operation in many ways.*

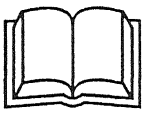
*I express my heartful thanks to my wife* **Sangita**, *whose co-operation, patience and encouragement has made it possible to complete this work. Daughters* **Silpika, Sadichha** *and son* **Raghav** *for their interest of this work.*

*I Must express my reverence and gratitude to my* **parents,** *brothers and sisters's families and other* **relatives** *whose benign supports and continued encouragement were great source of inspiration for me.*

*I am highly obliged to* **Mr. Sandeep Raj Prasai** *for the typing of manuscript and* **Mr. Manindra Prakash,** *Proprietor, Anupravesh Computers of Allahabad for the preparation and the printing of the work.*

Place : Allahabad
Date : 2.9.2002

**(Hari Prasad Thapaliya)**



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# ACRONYMS

| | | |
|---|---|---|
| AWB | - | Asian Wetland Bureau |
| BPP | - | Bio-diversity Profile Project |
| BZ | - | Buffer Zone |
| CBS | - | Central Bureau of Statistics |
| Cms | - | Centimeters |
| DNPWC | - | Department of National Park and Wild Life Conservation |
| FDD | - | Fisheries Development Division |
| GIS | - | Geographic Information System |
| GO | - | Government Organization |
| Ha | - | Hectare |
| HH | - | Household |
| HMGN | - | His Majesties Government of Nepal |
| INGO | - | International Non Governmental Organization |
| IUCN | - | International Union For Nature Conservation |
| Kgs | - | Kilograms |
| KM | - | Kilometer |
| KTWR | - | Koshi Tappu Wild Life Reserve |
| M | - | Meter |

| | | |
|---|---|---|
| MAB | - | Man And Biosphere |
| NGO | - | Non Governmental Organization |
| NP | - | National Park |
| NRs | - | Nepali Rupees |
| PPP | - | Park People Program |
| PRA | - | Participatory Rapid Appraisal |
| Qtls | - | Quintals |
| RCB | - | Ramsar Conservation Bureau |
| RCNP | - | Royal Chitwan National Park |
| RNA | - | Royal Nepal Army |
| SAARC | - | South Asian Association For Regional Co-operation |
| T.U. | - | Tribhuwan University |
| UK | - | United Kingdom |
| UNDP | - | United Nations Development Program |
| UNESCO | - | United Nations Educational, Scientific and Cultural Organization |
| USA | - | United States of America |
| VDC | - | Village Development Committee |
| VU | - | Village Unit |
| WC | - | Wildlife Conservation |
| WMI | - | Woodland Mountain Institute |
| WNH | - | World Natural Heritage |

# INTRODUCTION

# CHAPTER –1 INTRODUCTION

*Conservation is humanity caring for the future.*
*Nancy Newhall*

Wild life is the concept of a *species* that grow or lives wild in the area *i.e.* as well as being non-domesticated, the species must also be non-introduced. ***Domestic species*** are excluded from the definition of wildlife. The word wild life can, therefore, be equated with the term nature resources ***(Michael, 1986)***. Nature has been so kind to man. He has been dependent on nature for his subsistence. In initial stage of the history of economic development, man identified these natural gifts available around him and learnt to use them.

Everything that comes from the nature has some utility for man but its utilization is possible on the availability of appropriate technology. Although natural products ***(natural resources)*** existed over the earth's surface even during the prehistoric time, man had neither the tools nor the technology to use them. *Land, sunshine, wind, forest, and wildlife* were present much before the appearance of man on earth. With time he could learn to ***cultivate land, grow crops*** viz protecting different plants. He also learned to run the wind and water mills by using the wind and water energy. Hence these ***natural materials*** turned into resources only when they could be used. Conservation is the wise use of the country resources of land and water and wildlife for every purpose ***(Michael, 1986)***. Conservation of wild life is essential in their natural habitat. A number of activities have been implemented for effective conservation of wild life. Despite various attempts, conservation is going to be challenging in unprotected areas. The demand to conserve the species

in the particular wild area is simply called as the wild life Reserve. Although the process of selecting nature reserves has evolved over several decades ***(Sheail, 1976)***, this began with an agreement between European wild fowl experts. According to this agreement, the areas supporting more than certain arbitrary percentage of global, continental, or sub continental wild fowl population should be regarded as internationally important, requiring specific conservation measures. This approach gained wide acceptance and similar procedures to identify nationally important wildfowl site followed. Animal species or groups, which are both conspicuous and highly aggregated, lend them selves to this Reserve approach ***(Derek, 1986)***.

Koshi wild life conservation area (Koshi Tappu) is also a Reserve and is commonly called the ***Koshi Tappu Wild life Reserve*** (KTWR). It is one of the protected area which is facing intense pressure both from people and livestock. This Reserve is the only habitat of wild water buffalo ***(Bubalus bubalis)*** and several aquatic birds. Viewing the tremendous ecological importance, effective conservation of this Reserve is very essential. Fortunately the Reserve is very rich in biodiversity.

Bio-diversity simply means the wealth of life forms found on the earth; millions of different kinds of plants, animals, and micro-organisms, the genes they contain and the intricate ecosystems they form. Bio-diversity basically means "*variety in flora, fauna, and other micro-organisms within the natural ecosystems where animal diversity greatly follows plant diversity*" (***Khadka*** and ***Joshi, 1993***). The Koshi Tappu wild life Reserve (KTWR) has been enlisted in "***Ramsar site***" being one of the most outstanding wetlands for resident and migratory water fowls ***(Bajimaya,1993, Sah, 1997)***.

The recently amended National parks and Wildlife Conservation Act 2029 B.S. empowered the government to declare any area adjacent to parks or reserves as a ***"buffer zone"***. The present study is concentrated in the interaction between the people of buffer zone and the park authorities of Koshi Tappu wild life Reserve. The purpose of the study is

1. To find a solution to improve the relationship between the Reserve staffs and the adjacent people,
2. To increase the number of endangered species of the Reserve,
3. To provide benefits to the local people from the Reserve,
4. To improve the economic condition of the people and
5. To gather information on the economic condition of the people before and after the establishment of the Reserve.

The present work has been taken to study the response of the local people in relation to the establishment of the forest Reserve. The establishment of forest Reserve is of mutual interest to both the government authorities and the local people. There are certain benefits that the people of the adjoining area enjoying. They have been able to improve their breeds of buffaloes by hybridization. Male wild buffaloes are mated with the local breeds to get good, healthy and stout progeny. While on the other hand, the government is able to monitor regularly vanishing species of wild buffaloes.

But at the same time, both the group faces certain problems. The local people's major concern is to protect their crops from the ravages of the wild water buffaloes. The entry into the Reserve from the buffer zone has been restricted. But the illegal extraction of park

resources continued by the local people. Restriction on entry made people to feel the burnt of it.

Some work has been done on the flora and fauna of Tappu area. Since the establishment of wild life Reserve of wild water buffalo, the anxiety for knowing the reaction of the local people inhabiting around the Reserve area was prevalent. When the government decided to bring the project on conservation, the people of that area apprehended the possible impact of the Reserve that might affect their lifestyle of the men of the buffer zone. They thought that the park would improve their physical and economic status.

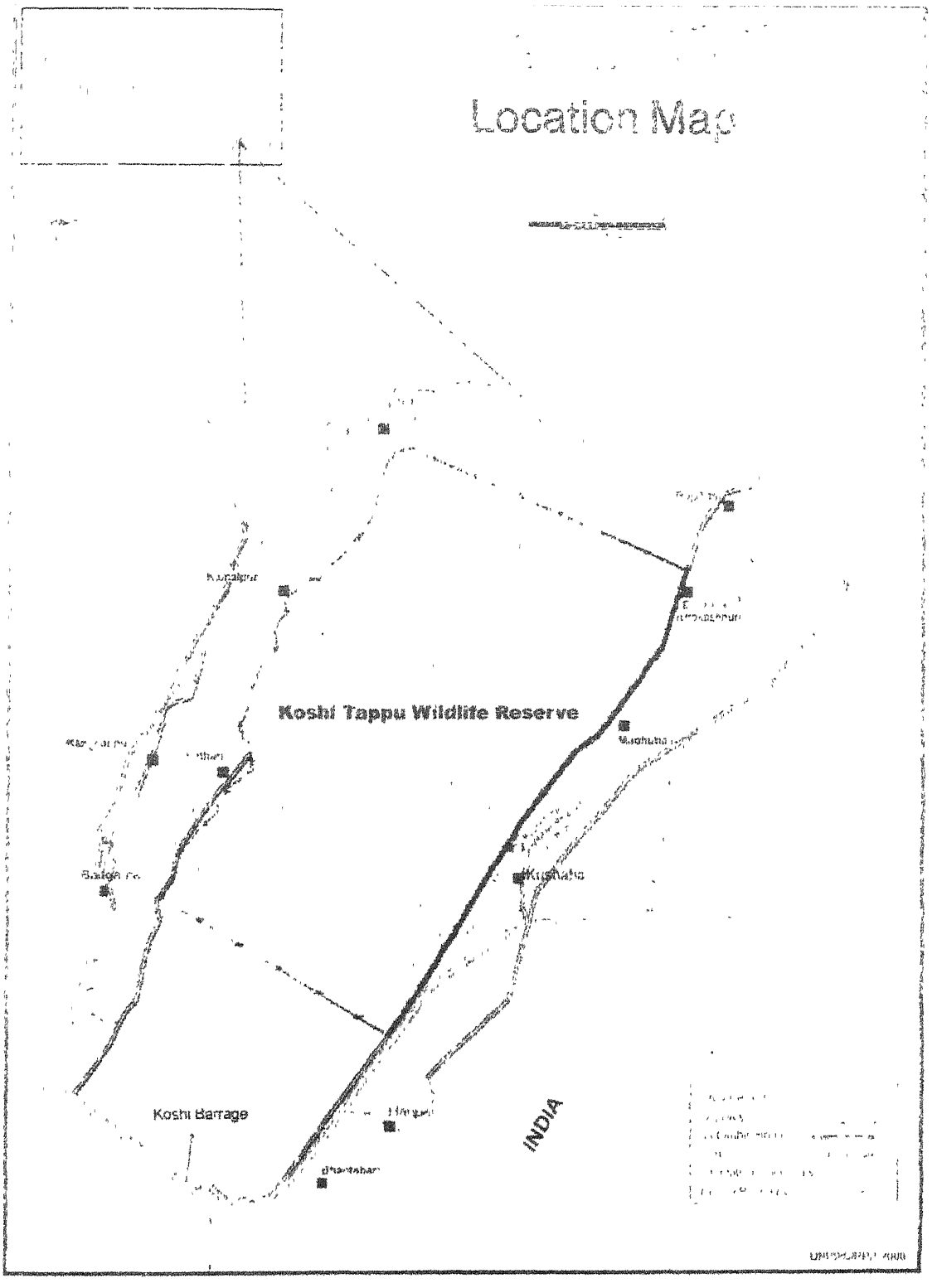
The greater variation in climatic conditions and varying altitudes and latitudes has enriched the biodiversity of Nepal. With the rapid increase in population and their settlement, there was rapid destruction of forest and other habitats of wild life. This in turn endangered, to the limit of extinction, a large number of animal and plant species. So, the concept of conservation was developed. According to history, the concept was developed and implemented with the establishment of world's first National park ***"Yellow Stone" USA (Mackinnon, 1986)***. This momentum reached ***Nepal*** in the establishment of the wild life conservation office in 1972 and promulgation of the ***National park*** and wild life conservation ***(NPWC)*** Act 1973. ***Nepalese Government*** now has established 8 national parks, 5 wild life reserves and 3 conservation areas, occupying a total

of 23872 sq. km of area, in addition to 2836 sq. km of buffer zone ***(Majpuria, 1998)***.

***KOSHI TAPPU WILD LIFE RESERVE (KTWR):***

Koshi Tappu Wild life Reserve is situated in the eastern part of ***Nepal***. The KTWR is rich in natural resources and is the ideal habitat for water buffalo ***(Bubalus bubalis)***. Being a marshy land, the area is full of wild grasses that grow vigorously. Wild water buffalo mostly use long hard stick grasses as their shelter. They prefer to hide themselves between these grasses along with other fauna and flora found in large numbers in these areas. There is regular water supply to the marshy land from the adjoining ***Koshi river***. During flood, the water spreads to these marshy lands. After resettling of river water, good quantity of water remains accumulated in the marshlands of this area. This makes a good inhabiting ground for water birds, fishes and varieties of other aquatic animals. Certain perennial trees like ***Acacia*** found in the area provides a nesting place for the local residential, and migratory birds. Their number is decreasing day by day due to which Government took initiatives to establish this Reserve.

The average rainfall of the KTWR ranges between ***1000 to 1200 mm*** as recorded at ***Phatepur*** of ***Saptari*** district, in 1994. In ***Chatara*** of ***Sunsari*** district the humidity remains high all the year around with the monthly average varying between 76% to 94%. The average daily maximum temperature ranges from 23.5$^0$c to 33.4$^0$ c. and the minimum temperature from 7.8$^0$c to 29.2$^0$ respectively ***(HMG 1986, 1988)***.


Location Map
Koshi Tappu Wildlife Reserve
Koshi Barrage
INDIA

The history of Koshi Tappu wild life Reserve (KTWR) can be ascribed to the establishment of the ***Koshi Barrage***. The Indian Government constructed it on Nepal India border under an agreement with Nepal Government for the purpose of flood control, irrigation, water supply and hydropower development. The earthen embankment constructed on both sides of the river was initiated in ***1954 AD***. The late ***King Mahendra*** had laid the foundation stone of the barrage in the presence of the ***Indian Prime Minister Jawahar Lal Nehru*** in 1958, and inaugurated the barrage after completion in 1965, in the presence of the ***Indian Prime Minister Lal Bahadur Shastri***.

In 1969, *His Majesties Government of Nepal* ***(HMGN)*** established six ***Royal Hunting Reserves*** in the ***Terai*** including ***Koshi Tappu***. At that time the Koshi Tappu was covered with dense riverine forest and tall grasses. It harboured diversity of animal species including ***Royal Bengal Tiger*** (*Panthera tigris*), ***Leopard*** (*Panther pardus*) ***Asiatic wild elephants*** (*Elephants maximus*), ***Asiatic wild water buffalo*** (*Bubalus bubalis*), ***blue bulls*** (*Boselaphus tragocamelus*), ***dolphin*** (*Platimista gangetica*) and ***swamp partridge*** (*Houbaropsis bengalensis*) ***(Sah, 1997)***. The construction of Koshi dam, Koshi barrage, road, railway lines etc have cleared the forest and eventually destroyed the habitat of large-sized wild animals. As a result, it had lost 80% carnivorous and 58% ungulates over the last 40 years ***(Heinen, 1993a)***. To strengthen protection efforts, a *Royal Nepal Army* ***(RNA)*** protection unit was developed for strict enforcement of law and the wild life Reserve Rules were enforced just after a year of

establishment in 1977. About 12000 people were moved out of the Reserve in 1979 ***(IUCN, 2002)***. Dahmer conducted first study on the status of *Bubalus bubalis*, in 1978.

In the year of 1980, the commitment of His Majesty's Government of Nepal ***(HMGN)*** helped in establishing a separate Department of National park and wild life conservation. After the establishment of separate department, the study of ***waterfowl, fishes, elephants*** and other remaining ***flora*** and ***fauna*** started.

In the year 1994, Department of National park and wild life Conservation ***(DNPWC)*** prepared a Bio-diversity profile of ***KTWR*** with the support of *Woodlands Mountain Institute/International Union of Nature Conservation/Nepal* ***(WMI/IUCN)*** and *Park People Program* ***(PPP)*** for buffer zone. It was also supported by *United Nations Development Programs* ***(UNDP)***.

This buffer zone was strengthened with the passing of the buffer-zone management regulation in 1992 and guidelines in 1996. The ***DNPWC*** initiated formulation of conservation strategy and integrated management planning of ***KTWR*** around its vicinity since 1998 (PPP, 2001).

Now a days, ***KTWR*** is mainly divided into four categories, which are:

(i) ***Riverine :*** it includes perennial rivers and river flood plains.

(ii) ***Man made :*** which includes water storage area like Koshi Barrage, canals and River fields.

(iii) ***Palustrine :*** includes marshes and herbaceous swamps formed by seepage canals and,

(iv) ***Lacustrine :*** which includes oxbow lakes and ponds ***(Sah-1997)***.

Mainly, the areas in the *Koshi Tappu wildlife Reserve* ***(KTWR)*** is divided into two main regions i.e. Reserve area or protected area inside and buffer zone area or residential area outside the boundary.

RESERVE AREA :

The Reserve area is mainly used for the protection of wild water buffalo in wetlands. It extends between $26^0$ 33'-$26^0$ 45' ***North*** and $86^0$ 54'–$87^0$ 04' ***East*** of the flood plain of ***Sapta Koshi River*** in the ***Terai*** of ***southern Nepal***. Previously the area covered was 175 square km but later in 2000, the GIS survey computed the total area as 149.6 sq. km. Its elevation ranges from 75 m to 100 m above the sea level. The ***Sapta Koshi River***, a major tributary of the Ganges, drains it. A small branch of river ***Trijunga*** also joins in Koshi ***(Sah and Suselo, 1996)***.

The Reserve is basically the flood plain of ***Sapta Koshi River*** system with an area of 17,500 hectare and lies upstream of the Koshi barrage across ***Sunsari*** district of Koshi zone; ***Saptari*** and ***Udayapur*** districts of ***Sagarmatha Zone***. The Koshi Tappu Wild life Reserve is rectangular in shape; 16.4 km long and 9.4 km wide. This ***Sapta Koshi River*** (fed by major tributaries ***Indrawati, Bhote***

***Koshi, Tama Koshi, Linku Dudh Koshi*** and ***Tamor***) is in ***eastern Nepal***. ***KTWR*** is a remarkable wetland habitat in terms of its distinctive characteristics. The ***Ramsar*** site of Nepal was declared in ***Dec 1987*** as a wetland habitat of international importance, particularly for waterfowls and wild water buffaloes ***(Scott, 1989)***, and as a vegetation type locality of pseudosteppe graminoid grassland ***(Shrestha, 1996)***.

The Koshi Tappu Wild life Reserve lies in the northern part of ***Gangetic*** plain and its alluvial deposits are mainly composed of fine sand, silt and clay that frequently alternate in different proportion ***(Ohta*** and ***Akiba 1973)***. The nutrient content of the soil varies greatly, depending upon the time of sedimentation and the establishment of vegetation in subsequent years.

In KTWR, ***5 types of soil*** have been reported i.e. ***(i) Sandy (ii) Sandy loam (iii) Loam (iv) Sandy clay loam*** and ***(v) Clay loam***. It is found in buffer zone ***(Pradhan et. al, 1967).***

***Sandy soil*** varies in ***colour*** from ***Grey brown*** to ***dark Grey brown***. The soil is moderately alkaline with the average pH of 8.1. Its nutrient status is low with respect to all major nutrients, viz. nitrogen, phosphorus, potassium and organic matter. This type of soil is most common in the villages of ***Madhuwan, Kusaha, Kamalpur*** and ***Ghoghanpur*** VDC.

***Sandy loam soil*** varies from ***dark brown*** to ***light olive*** in

colour. Its ***pH*** varies slightly from acidic to moderately alkaline (5.2 to 7.75) and the nutrient status is low with respect to nitrogen and low to medium in phosphorus, potassium and organic matter.

***Loam soil*** colour varies from ***dark gray brown*** to ***light olive*** and its ***pH ranges*** from 5.8 to 7.9. The fertility status of soil varies from low in term of phosphorus content, medium in potash, low to medium in nitrogen and low to high in organic matter. This type of soil is common in the villages of ***Haripur*** and ***Kusaha*** VDCs.

***Sandy-clay-loam*** and ***clay-loam soils*** have been reported from the villages of ***Ghoghanpur, Jagatpur*** and ***Badgama*** VDCs of ***Saptari***. The colour of those types of soil is ***dark brown*** to ***olive. PH*** varies from 5.35 to 7.25. These types of soil are moderate to highly fertile. The nutrient status of soil is low in term of phosphorus content, medium in potash, low to medium in nitrogen and medium to high in organic matter content ***(Pradhan et al, 1967)***.

Besides, the flora and fauna, the river in the Koshi Tappu Wild life Reserve has created a good number of different types of habitats, viz, ***Swamps, Lakes, Oxbow lakes*** and ***ponds*** that harbour a good quantity of fishes. These wetlands also serve as breeding and feeding grounds for birds ***(Sharma, 1996)***.

This area was gazetted as a wild life Reserve in 1976. It contains Nepal's last Surviving population of wild water Buffalo (*Bubalus bubalis*) and its natural habitat. ***DNPWC*** has been implementing PPP

in KTWR since late 1994 with the support of *United Nations Development program* ***(UNDP)*** aiming to conserve bio-diversity of the Reserve through an integrated core and buffer zone management approach ***(PPP, 2001).***

VEGETATION :

Although the entire Reserve is represented by a single tropical bio-climatic condition ***(WMI/IUCN-Nepal, 1994)***, diverse assemblages of 514 species of plants belonging to 110 families have been recorded from the Reserve ***(IUCN 1998)***. Out of the total species, 502 are mostly Graminae belonging to 99 families of flowering plants and 12 species belong to 11 families of pteridophytes. Lacustrine habitat, like the oxbow lake of ***Kamalpur***, has 28 species ***(Sah, 1997)***.

The flowering plant species recorded from the Reserve accounts for about 13% and 4.7% of total flowering plants recorded for the ***Terai*** and the country respectively ***(WMI/IUCN-Nepal, 1994)***.

The vegetation of the Koshi Tappu Wild life Reserve has been described by ***WMI\UCN- Nepal (1994), Sah (1997), IUCN (1998)*** and several other researchers. According to the above authors, the vegetation in terrestrial habitat of the KTWR has been classified into three main types, viz. ***grass land*** (67.3%), ***Savannah*** (2.6%) and ***forestland*** (4.2%). Four distinct types of forest are identified by their dominant species. Among these four species two predominant species are:

(i) ***Khair*** (*Acacia catechu*) which is a typical riverine forest found

mostly near the banks of rivers on islands surrounded by segments of braiding river.

(ii) ***Sissoo*** (*Dalbergia sissoo*) which is predominated in most of the forest patches in the KTWR; the crown cover ranges between 10-40%.

In the entire Reserve, the ***Khair*** forest is less prevalent in comparison to the ***sisoo forest***. The main vegetation of khair forest are *Cynoglossum zeylanicum*, *Solanumm nigrum*, *Persicarva barbatum*, *Salanum tortum*, *Vernonia cinerea* and *Cynadon daitylon*. While grand vegetation in ***sisoo forest*** consists of *Cyperus dictomos*, *Eupatorium odoratum*, *Arundinella* sp, *Eupatorium adenaphorum*, *Solonum indicum* and *Cirsicum wallichi*.

Mixed deciduous riverine forest in the KTWR area occupied 2.87% of area in 1991 and was characterized by Bombax speciess ***(Simal in Nepali)***, usually associated with a number of other tree species. Mixed forest is mostly confined to areas away from the river where the soil has been further developed by the forest alluvium. In the forest, climbers like *Solena hetesophylla*, *Momordica charantia* and *Boerhavia diffusa* and others like *Artemisea vulgaris*, *Calatropis gigantia*, *Lantana indica* and *Eupatorium adenophoium* growing better in relatively dry conditions. The forest cover was 19.5% in 1959. However, with the shift of the river to its present position and change of forest into grassland with high deposit of sand and gravel, a major portion of forest was destroyed, leaving only a narrow belt covering 4.2% of the total Reserve area in 1992 ***(Sah, 1997)***.

In protected area, 70% of the total area is covered by grass

land/ savannah type of vegetation, which is flooded annually during monsoons and dominated by *Saccharum phragnites* association. This is a feature of flood plains of the Reserve ***(IUCN, 2001).***

The important species of the ***Grassland/ Savannah*** of the KTWR are :

i. ***Saccharum pharagmitis,*** which occurs on the banks of the ***Sapta Koshi river*** floodplains, in the forest and in moist places. ***Biomass production*** in this type of grassland ranges from 6.2-23.7 ton/ha.

ii. ***Saccharum*** Type occurs near the running water bodies; associated species are *Persicarea barbata, Tetrastigma serrulata, Cucurbitacea, Fimbristylis, Persicaria, Blumea, Sida, Eupatorium, Desmadium, and Dplazium* ***Biomass production ranges*** from 15.3 – 22.1 tons/ha.

iii. ***Imperata*** Type, which occurs on the drier sites and between the forest patches. The associated species are *Desmedium triflorum* and *Imperata cylindinca.* ***Biomass production*** in this type of grassland ranges from 1.4 to 2.5 ton/ha.

iv. ***Cymbopogon saccharum*** type of grassland occurs in comparatively drier places of the Reserve. The species associated with this type of grassland are *Phragmitis* sp and *Desmodimn triflorum.* The ***Biomass production ranges*** from 0.8 to 1.1 ton/ha ***(Peet et al, 1999, WMI/IUCN-Nepal. 1994).***

WILD-LIFE :

The Koshi Tappu wild life Reserve harbours an exceptionally diverse wild life population. It supports about 45% of total vertebrate species of the country ***(IUCN, 1998)***. 31 species of mammals ***(BPP, 1995a)***, 461 species of birds ***(Baral, 2000)***, 117 species of fishes ***(BPP, 1995b)***, 46 species of amphibian and reptiles ***(BPP, 1995a)*** and 77 species of butterfly have been reported ***(BPP, 1995d)***.

***Shakya*** (1994), after a study of KTWR, reported that it consists of 80.8% of grassland, 12.9% of wetland and 6.3% of Reserve forest area having diversified fauna. The Reserve area contains about 17% of mammals, 50% of birds, 63% of fish and 26% of amphibians and reptiles species of the country ***(BPP, 1995 a,b,c,d).*** It is the only place of Nepal where ***wild water buffaloes*** (*Bubalus bubalis*) are protected. Common species like ***Chittal*** (*Axis axis*) and ***Nilgai*** (*Boselphus tracolamelus*) of the past are now rarely seen. It was also a good habitat for ***Gangetic dolphin*** (*Platanista gangetica*) in the past but now they cannot be seen in the upstream of the river. The carnivores like ***Jungle cat*** (*Felis chais*), ***Toddy cat*** (*Paradoxesus hermaphroditus*) fox (*Vulpes bengalensis*) and ***Jackal*** (*Canis aureus*) etc are almost common. The common ungulates of the KTWR which includes ***hog deer*** (*Axis porcinus*), ***spotted deer*** (*Axis axis*), ***barking deer*** (*Muntiacus muntjak*) and ***wild boar*** (*Sus serofa* ) etc have not shown any satisfactory increase in number ***(Thapaliya*** and ***Tiwari, 2000).***

The KTWR is important for ***migrating waterfowl***. Among those ***migratory birds*** staying in winter, around 50,000 ***pintail*** (*Anus*

*acuta*), 7000 ***lesser whistling teal*** (*Dendorcygna Javanica*), 4000 ***ruddy shelduck*** (*Tadoma frruginea*), 2000 ***common teal*** (*Anas crecca*), 18,000 ***Graganey*** (*Anas querquedula*) and other water fowl species have been observed ***(Scott, 1989)***. Among these different species of birds, few are endangered, some are susceptible and some are vulnerable.

***Python*** (*Python molurus*) are commonly found in wetlands while ***Gharial*** (*Gavialis gangeticus*) and ***Crocodile*** (*Crocodylus palustrus*) are common in the river. ***Snake species*** like ***Checkered Keelback*** (*Xenochrophis piscator*), ***King Cobra*** (*Ophiophagus hannah*) etc has also been reported, but their number is decreasing day by day due to fire and flooding. ***Lizards*** and ***Amphibians*** are also common but they will need more protected area for their continued survival. There are 23 threatened species of herpeto fauna ***(amphibian*** and ***reptiles)*** of which 17 are nationally threatened species. 6 of these species are globally threatened. The common species of fish are ***Sidhra*** (*Puntius conchonius*). ***Bhitti*** (*Damoreoo*), *Chela cachius, Somileptes gangota, Mystus tengra* and *Calisa sopta* from ***Kamalpur Daha*** have been reported in the new record of fish. Besides, 91 species of fishes are resident, 21 species are local migratory and 5 species are migratory. ***(BPP, 1995(b) and Sah, 1997).***

The common butterflies of this Reserve are *Buploea core* ***(common Indian crow)***, *Catopsilia pyranthe* ***(Emigrant)*** and *Danaus chryssipus* ***(common tiger)***, have been frequently observed in the field

visit from October to January.

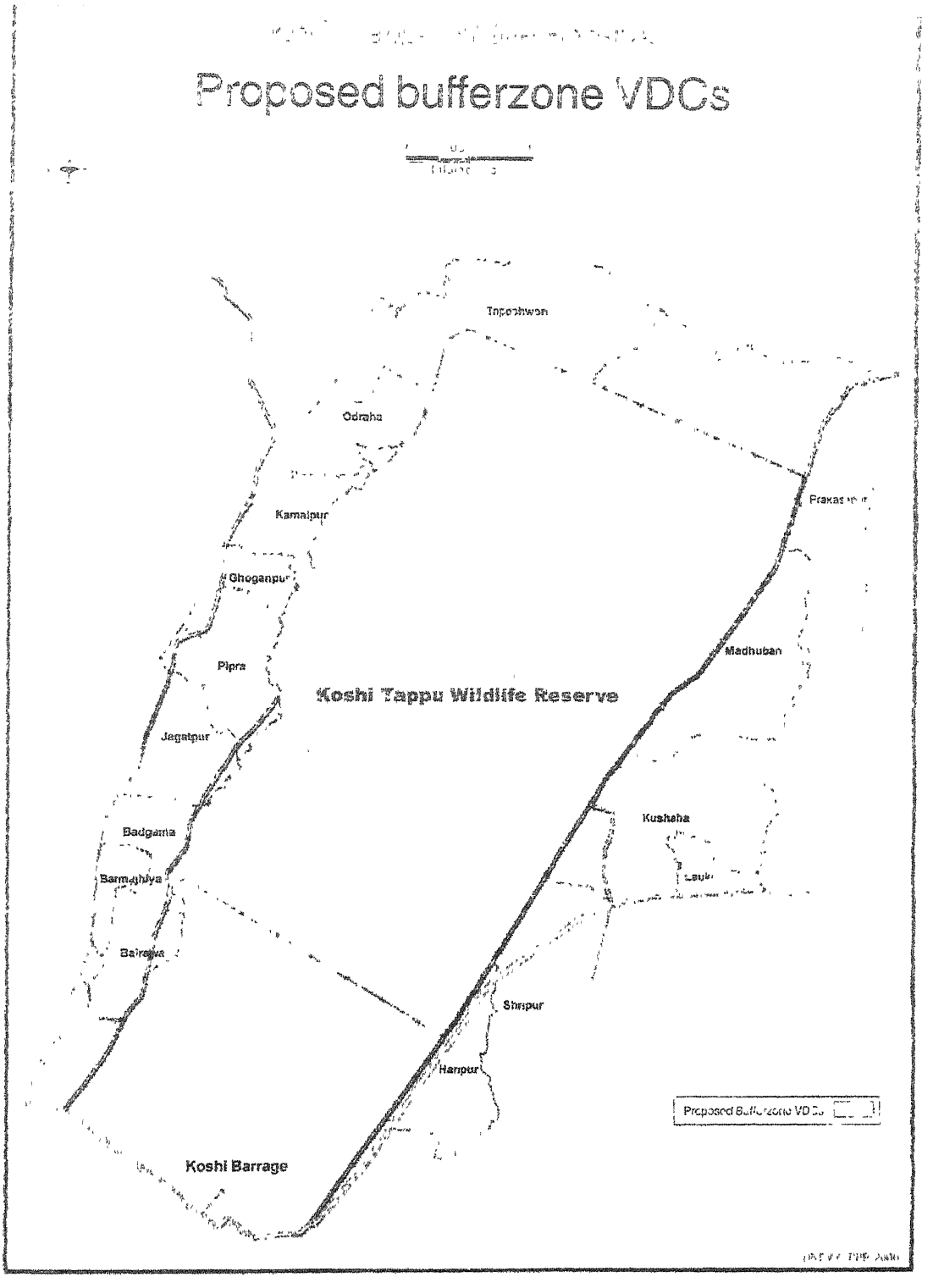
One species of fish ***Colisa sota*** (recorded from ***Kamalpur oxbow lake***), two species of birds ***Gallicrex cimerea*** and ***Trichastoma abbotti*** and one species of mammal, ***Bubalus bubalis*** are endemic species of the Reserve; they have not been reported from any other part of the country ***(Inskipp, 1989, WMI/IUCN-Nepal; Suwal and Verheugt, 1995)***. During the heavy monsoon, the barrage gates of the Koshi are closed to regulate the floodwater, which consequently causes drowning of wild life inside the Reserve, so some mammal escapers are killed in adjoining field. This is a major threat to bio-diversity resulting in the extinction of vegetation. Wild animals are also endangered and increase in population is not constant. The logs and woods of plants are used unscientifically resulting in the gradual declining of the flora to their possible extinction. Consequently, the fauna of the Reserve is also affected resulting in their diminishing population ***(Thapaliya and Tiwari, 2000).***

## BUFFER ZONE :

*To a man with an empty stomach, food is god.*

*Gandhi*

The Department of National Park and Wild Life Conservation proposed the buffer zone concept for some particular places of Nepal. His Majesty's Government is gradually declaring the area surrounding the national parks and reserves as buffer zone through the 4th amendment in the ***NPWC Act*** of 1973 in 1992. This Act defines buffer


Proposed bufferzone VDCs
Odraha
Kamalpur
Ghoganpur
Pipra
Jagatpur
Badgama
Barmajhiya
Bairawa
Koshi Tappu Wildlife Reserve
Madhuban
Kusaha
Shripur
Hanpur
Koshi Barrage
Proposed Bufferzone VDCs

as the peripheral area of national park or Reserve declared under section 3a of the Act and this section refers to the villages, settlements or hamlets set aside as buffer zone lying within the national park or Reserve ***(HMGN 1999)***. The factors such as geographical location of the Reserve, area of the Reserve, status of the settlements and appropriateness from the point of management are also considered for the declaration of buffer zone. The extent and area of the buffer zone in the context of Nepal has been determined on the basis of an impact zone concept and thorough consultation with the local communities is involved ***(Sharma , 1991)***.

Buffer zone is being ribbed in the form of ***agricultural lands*** and ***grasslands***. Small patches of annexed riverine forests occur along embankment between ***Prakashpur*** and ***Rajbas*** *Village Development Committee* ***(VDC)*** of ***Sunsari*** District. The Sal forest of ***Bhagalpul*** area, which is the southern part of large ***Trijuga forest***, serves as an important habitat of different animals ***(IUCN, 2002)***. Considerably small grassland is present in the floodplain situated at the northern part of the Reserve in ***Saptari*** district. The agricultural lands of the buffer zone are important habitats for several invertebrates, amphibians, reptiles, birds and small mammals. The bamboo bushes, large tree species and ***Simal*** occurring within the agricultural lands and road sides serve as roosting and nesting sites for many bird species. The vegetation composition of buffer zone grasslands is not very different from that of the grasslands inside the

Reserve ***(IUCN, 2002)***.

The buffer zone of KTWR is dominated by ***cultivated land*** (86.5%). The rest is grassland. River, sand and boulders cover 6% of grassland, 5.6% is covered by swamp and 0.6% by orchards. The total buffer zone in the eastern sector covers 57% and the western sector covers 43% area. In contrast, total house holds residing in the eastern side is 44.4% and in western side 55.7%. Thus, household on an average covers 1.52 ha on the eastern sector and only 0.87 ha on the western sector. Comparison of land use pattern of eastern and western side of buffer zone shows that the cultivated land covers 90.4% on the western sector, and 83.6% in the eastern sector. This is followed by river, sand etc which covers 7.5%, in the eastern sector, on the other hand, grassland, which covers 4.5%, occupies the second dominant area in the western sector. The land use changes between 1978 and 1992 reveal that the cultivated and grassland area increased by 7.3% and 8.5% respectively, whereas the swampy area, and area under river, sand etc decreased by 9.0% and 6.8% respectively. Moreover, 122 ha (0.7%) of the total proposed buffer zone was covered by forest in 1978 while none in 1992. During the same period about 2740 ha (15.5%) of wetland has been converted to cultivated area. Similarly, the area of 122 ha, that existed in 1978, was depleted by 1992. Instead, an orchard area of 86 ha. has been developed ***(DNPWC/PPP 2001)***.

The land use in the Reserve during 1991/92 is ***dominated by***

***Grassland***, which spread over 67.3%. After 14 years, there has been a drastic change in land use; rivers/sand/boulders covered more than half of the Reserve area (53%) in 1978, while it covered only 26% in 1992. Moreover, no swamp was recorded in 1992 but 17% of total Reserve area was recorded as swampland in 1978. The forest area did not change much between 1978 and 1992. Similarly, about 7% area was recorded as cultivated land in 1978 but no cultivated land was recorded inside the Reserve in 1992 ***(DNPWC/PPP, 2000)***.

## SOCIAL AND ECONOMICAL STATUS :

*It is not in the stars to hold our destiny but in ourselves.*

*Shakespeare*

There are mainly two types of ***family system***. The first is one of the ***indigenous families*** of the ***Terai people*** and other one is the family of the people of ***hilly regions***. The Terai people mostly live in joint family while the hill people live in nuclear family system. The average size of family of Terai ethnic group is 8 whereas that of land migrant groups is 6. The family system is mainly guided by the way of living, culture and religion. Hindu families have about 7 members, while Muslim have more (up to 8) ***(Sah, 1997)***. It is also influenced by economic condition, education and occupation. People engaged in service and businesses have nuclear family while those in agriculture or animal husbandry live in joint family.

The over-all ***literacy rate*** in buffer zone is 44.6%, whereas ***female literacy*** is 36.4% against ***male literacy*** of 53%. ***The girls***

***attending*** school of hill migrants are more than those of ***Terai educated families***, which is 1.2% while corresponding to ***male*** is 3.6%. School attendance of girls is poorest from Muslim community. Early marriages are still prevalent which may be a limiting factor for girls schooling ***(Sah, 1997)***

About 87.3% of the people in the buffer zone are involved in ***agricultural activities***, i.e. 51.2% is involved in farm activities including animal husbandry, 36.1% of people are partially involved in agriculture and allied activities. Besides agriculture, 4.8% are in trade, 6.8% are in service and 1.1% minority groups such as ***Malaha, Ghongi*** are involved in agriculture labour besides their traditional occupation of fishing to supplement their minimal cash incomes ***(DNPWC/PPP, 2000)***.

The people migrating from the buffer zone form only about 1%, contributed basically by some large landholders migrating to urban centers. Immigration was high in northern boundary of Reserve called ***"Sri Lanka Tappu"***. People immigrate mainly from the hilly area of ***Udayapur*** district and from ***Bihar state of India (Sah. 1997)***.

Agriculture production is enough to subsist 3 months for 36% households in the buffer zone. Hence, besides agriculture, they work as wage labours. People migrate for seeking job and fishing etc. to make living in other months. 31% households' production is adequate for 3 to 6 months and in other months they are dependent on off-

farm activities. Only 22% households have enough production for the whole year, while 11% households have surplus production which is sold in the market ***(Sah, 1997, Heinen, 1993)***

Among the households who do not have enough production 58% are involved in wage earning, 19% are involved in sharecropping, 5% in fishing and others. Some seasonally migrate in search of employment; few work temporarily as full time labours in other houses. Others are involved in firewood selling, timber trading and other businesses ***(DNPWC/PPP-2000).***

Besides the ***farming of varieties of crops***, ***fish farming*** is one of the most important economic activities in ***Terai***. It is also popular around Koshi Tappu because of relative abundance of fish in the Koshi River and associated wetlands. Outside the Reserve, fishing is most common in the area near the barrage, in the seepage stream and marshes along the eastern boundary of the Reserve. Fishing inside the Reserve is banned. Perhaps, it is commonly practiced in the ***Trijuga River, Kamalpur Daha*** and ***some part of the Koshi River. PPP*** (*Park People Program*) has been encouraged for the people of buffer zone. As a result, few private fishponds have been developed and are integrated with duck and poultry farming. In 1994, the project for fish stocking and cage culture in Koshi Tappu was implemented and was very successful. But it was terminated after 3 years because of dispute in community ***(DNPWC progress report, 1998)***.

According to ***Socio-economic survey*** of ***DNPWC/PPP in 2000***,

39% household of buffer zone are either landless, or possess less than 0.5 ha of land. 31% households owned 0.5 to 1 ha, 20% owned 1 to 3 ha, and 10% owned more than 3 ha of land. This record shows the 70% of households own less than 1 ha land, which is not sufficient to feed the average family size (7.2) of buffer zone.

***Fruits*** are also grown in this region though not as a cash crop. ***Mango, Litchi, Jackfruit*** and ***Banana*** are the main fruits of this area. The land occupied by fruit trees is very small about 0.59% of total land. The people of the buffer zone grow vegetables mainly for their own consumption. Few of them grow vegetables as a cash crop. The ***Paddy*** is the main crop grown in monsoon as well as summer. In some places it is grown twice a year. ***Wheat, oilseed*** and ***pulses*** are grown in winter. ***Maize*** and some other ***cash crops*** like ***sugarcane*** (*Saccharum officinarum*) and sunflower are also grown in summer. In eastern boundary of buffer zone, most of the VDCs remain wet for whole year, therefore the productivity of paddy is better but the production of wheat and other crops are low. In the west, ***VDCs*** of the Reserve remain dry seasonally and so the Reserve productivity of paddy and other crops is comparatively lower than that of the eastern ***VDCs (Heinen, 1993, Shrestha, 1993, Sah, 1997, DNPWC/PPP 2000).*** According to ***DNPWC/PPP survey*** in 2000, the buffer zone possessed 14,310 local and 331 improved cows, 4,971 local and 16 improved buffaloes. Collectively, the buffaloes and oxen are 9,950 while sheep and goats are 163,210. The average livestock holding is higher in the western sector than in the eastern sector. Few ethnic

groups rear pigs for meat and cash income. The total number of pig in the buffer zone was 4587, of which 450 were of improved breed. There were about 126,543 ducks and 134,724 chickens recorded in the buffer zone of KTWR.

## CONFLICT ISSUE :

For ***different threatened species***, the wild life Reserve had been quite successful ***(Mishra et al, 1992)***. This conservation of habitats has increased wild life population within protected areas and they started damaging outside the park. Hence it causes the unbalanced relationship between park and people. Damaging of agricultural crops, human harassment, live stock depredation and injuries to neighbours of park are the main reason of imbalanced relationships ***(Heinen, 1993a, Sah, 1997)***.

The second issue of conflict is park itself because it is a good source for neighbour to fulfil their resource needs through venturing into illegal poaching, lodging and hunting. These are straight conflicting issues of the park objectives ***(Milton and Binney, 1980).***

Moreover the maximum conflict has been observed in the eastern region of KTWR rather than in the western region, mainly due to a big damage of crops by ***wild water buffaloes*** (*Bubalus bubalis*) ***(Thapaliya*** and ***Tiwari, 2000)***. The people of the eastern region also have complaints against soldiers, wardens and Reserve staffs, and these are rather less in the western region.

In KWTR, people have been denied the rights to use the resources and they have no rights to claim compensation for the damage to their crops by wild life. It is also considered the main issue of conflict between park and people ***(Warden's office).***

## ECO-TOURISM :

In the Koshi Tappu, Eco-tourism is permitted but very little information is given to the local residents. According to the warden office, the tourists or visitors are increasing year by year. More than ***30% of visitors*** are either from ***Nepal*** or ***India*** and rest are from other foreign countries. There has been slight increase in the number of foreign visitors from 1995 to 1999. The number of foreign visitors and visitors of Indian/Nepalese nationality were 266 and 488 respectively in 1995. After 4 years (in 1999), it increased to 469 (foreign) and 2067 (the Nepali/Indian) respectively.

The revenue for the Reserve is collected from entry fee, elephant ride and jungle safari, which is increasing. It was 182270 NRs in 1995 while it increased up to 40,2685 NRs in 1999. Maximum revenue comes from jungle safari by foreign nationals. The tourists from developed countries visit the Reserve for bird watching and boating in the ***Sapta Koshi***, and also to observe wild buffaloes and other wild life. About 70% of the bird watchers are of British nationality. The substantial proportion of tourism benefit either goes directly into the Reserve revenue or to the 4 hotels located in the buffer zone. About 20 households have been benefited from employment in the hotels

***(Warden office).***

*Bubalus bubalis* :

*Bubalus bubalis*, the wild buffaloes, are the ancestors of domestic buffaloes in the ***South Asia region*** (Encyclopedia, mammals 1984). There are six varieties of wild water buffaloes, which have been reported so far. *Bubalus bubalis arnee* ***(Arna)***, *Bubalus arnee fulrus* ***(Assan water buffalo)***, *Bubalus arnee migon* ***(Ceylon water buffalo)***, *Bubalus arnee*, *Babalus arnee hewai* ***(Borneo water buffalo)*** and *Babalus arnee mindoresic* ***(Tamabou)*** are the main varieties. The ***wild water buffalo*** (*Bubalus bubalis*) is the species, which is found in the Koshi Tappu and is reported endangered ungulates. The wild progenitor of domestic water Buffalo is widely used as dairy and drought animals in ***Asia, Europe*** and ***parts of North America (Cockrill, 1974)***. This wild variety is named ***Arna*** in ***Nepali***. This beast is one of 26 mammals' species in Nepal listed for protection under the National Park and wild life ***conservation Act 1973***. In the past decade ***Bubalus bubalis*** was found throughout the low land of ***South Asia***.

In ***Nepal***, it was recorded in the low land of the ***Royal Chitwan National Park*** until the decade of 1960s ***(Sah, 1997)***. The population of this beast is nearly extinct because of a few communicable diseases transferred by the domestic livestock. Only few water buffaloes are confined in KTWR and the Reserve was created specially for the

conservation of this endangered species ***(Thapaliya*** and ***Tiwari, 2000)***. Various workers viz. ***Gupta*** and ***Mishra*** (1972), ***Dahmer*** (1978), ***Bauer*** (1987), ***Heinen*** (1993), ***Suwal*** (1993a), ***Bhandari*** (1998) and ***Chaudhary*** (2000) have also worked on behavioral and ecological aspects.

The number of ***Arnas*** (*Bubalus bubalis*) varies from year to year. It was 63 in 1976 ***(Dahmer, 1978)***, 100 in 1986 ***(warden office)***, 91 in 1987 ***(Heinen, 1993a)***, 93 in 1988 ***(Heinen, 1993a)***, 158 in 1993 ***(Suwal, 1993)*** and 145 at the end of 2000 ***(Heinen, 2001)***. The Reserve is protected on one hand by the wild life staff of DNPWC and by the soldiers of ***Royal Nepal Army*** (RNA) on the other hand ***(Wardens office)***. Both units are jointly looking after the welfare of the Reserve area.

## RAMSAR SITE :

There are also ***oxbow lakes*** and ***riverside marshes*** within KTWR. The freshwater marshes and ponds are formed by the seepage from ***Koshi River*** in burrow pits between eastern embankment and the cultivated lands. The submerged land of 49.6 sq. km between the Koshi barrage and southern boundary of the Reserve is specially used for the breeding, feeding, and nesting site of resident migratory birds and is also an important place for bio-diversity conservation. The endangered species such as ***swamp partridge***, ***Bengal florican***, ***gharial crocodile*** and ***Gangetic dolphin*** have been sited inside the Reserve and its surrounding wetlands. Moreover, many of the birds

and aquatic life that uses the Koshi Tappu also move to and from other wetlands.

Thus the KTWR is also the Reserve for ***migratory birds*** and is regarded to have an open ecosystem in connection to other ecosystems. Some birds come from far away ***Siberia*** and these migratory birds rest, breed and shelter themselves for certain time. Due to these unique natures or peculiarities of the KTWR, it was designated as ***Ramsar site*** in 1987.

## STUDY AREA :

*Park People Program* ***(PPP)*** has declared the 16 Village *Development Committee* ***(VDC)*** as a buffer zone or affected area of the Reserve out of which 12 VDC's have been selected under three districts ***Sunsari, Udaypur*** and ***Saptari*** of buffer zone for the study.

***Prakashpur*** VDC is in ***Sunsari*** District, and is situated in the northeastern side of the Reserve. It almost covers an area of 2564 ha. ***Cultivated land*** of this VDC is 1660 ha, ***grassland*** comprises 421 ha and river, ponds and sands cover about 483 ha where the land of 9 wards of this VDC was kept in Buffer zone. Hence all ward of VDC are affected by wild life. The cultivated land per capita in the VDC is 0.24 ha.

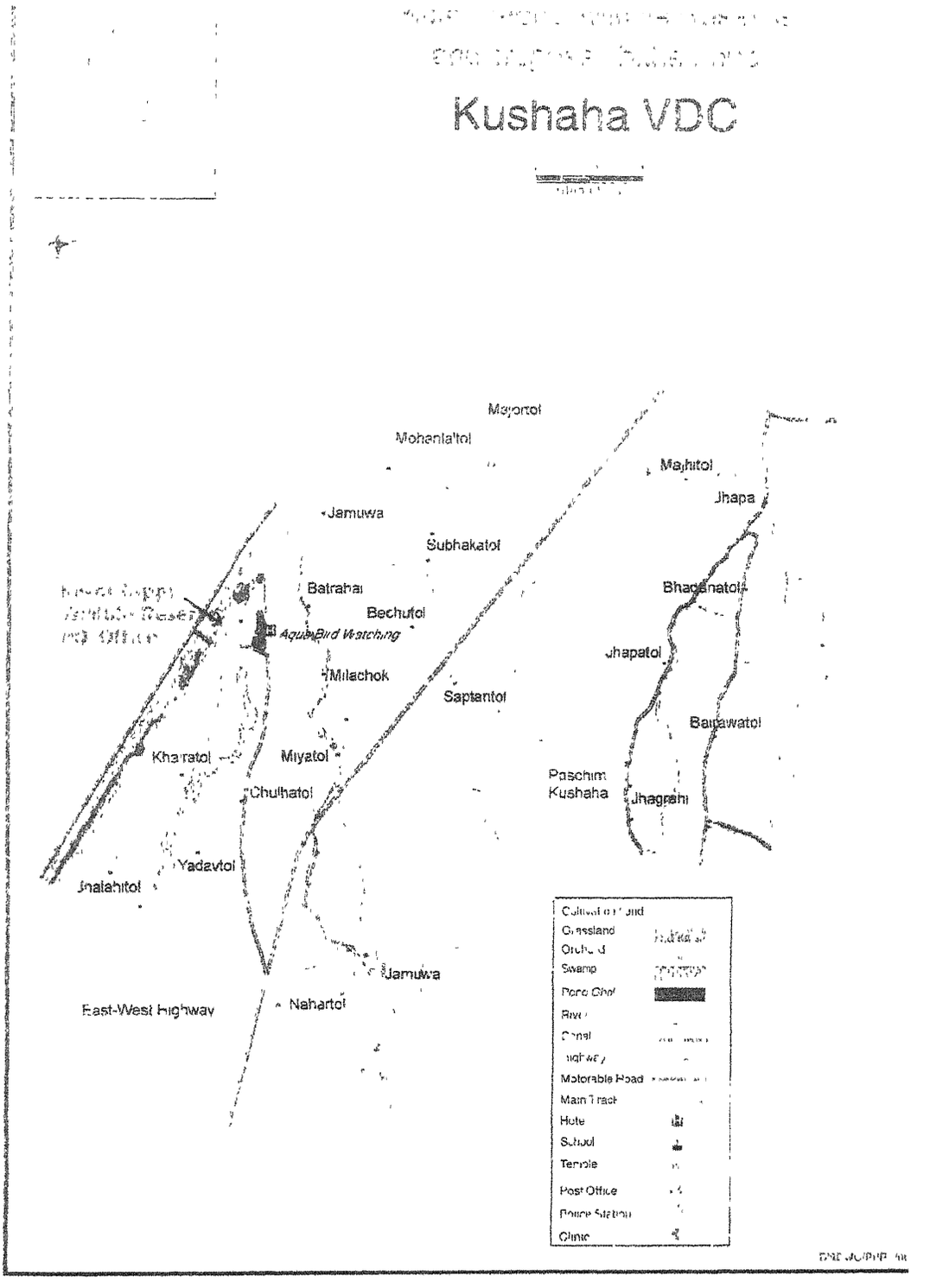
***Madhubn*** VDC is also in ***Sunsari*** district and ıs situated in the southern part of ***Prakashpur*** VDC. The total land of this VDC used in Buffer zone is 1111 ha. The ***cultivated land*** of this VDC is 1054 ha, ***Grassland*** 03 ha, Swamp 43 ha and river and sand covers about 11 ha.. ***Divisible land*** per capita is 0.13 ha, 9 wards of the VDC are directly affected by the Reserve.

***Kusaha*** VDC is situated in the eastern middle side of the Reserve in ***Sunsari*** district of which 9 wards are affected by the wild life directly and all the wards are included in Buffer zone. Total area of VDC is 1599 ha, where 1533 ha is cultivated, 13 ha grassland, 10 ha orchard, 34 ha swamp and 9 ha river & sand are clearly visible. 0.11 ha of land per capita is recorded in this VDC.

***Shripur*** VDC is situated in the ***Southern part*** of ***Paschhim Kusaha*** VDC. The Reserve directly affects 4 wards of this VDC and are included in the buffer zone. Total affected area of this VDC is 890 ha. . It comprises of 887 ha of ***cultivated land***, 28 ha of ***orchard***, 68 ha of ***Swamp*** and 7 ha of ***river*** and ***sand***. The land distribution is 0.13 ha/ per capita.

***Haripur*** VDC is situated on the east side of the southern part of the KTWR in ***Sunsari*** district. The buffer zone includes 5 Wards of this VDC close to the reserves. Total area of the buffer zone in this village is 738 ha of which 686 ha. of land is ***cultivated***, 4 ha. for ***orchard***, 15 ha for ***swamp*** & 33 ha. for ***rivers & sands***. The land distribution is 0.24 ha. per capita.

***Tapeshwori*** VDC is situated in the ***west*** and far ***northern side*** of KTWR in ***Udayapur*** district. About 6 wards of this VDC are directly affected and are included in buffer zone. Total land of the area is 1558 ha. of which 1147 ha. is covered by ***cultivated land***, 240 ha is ***grass land***, 3 ha ***orchard*** and 168 ha. is ***river*** and ***sands***. The land distribution is about 0.12 ha. per capita.


Kushaha VDC
Majortol
Mohanlaltol
Majhitol
Jhapa
Jamuwa
Subhakatol
Batrahai
Bechutol
Bird Watching
Milachok
Saptantol
Jhapatol
Kharatol
Miyatol
Chulhatol
Paschim Kushaha
Jhagrahi
Yadavtol
Jhalahitol
Jamuwa
East-West Highway
Nahartol
Cultivated Land
Grassland
Orchard
Swamp
Forest
River
Canal
Highway
Motorable Road
Main Track
Hotel
School
Temple
Post Office
Police Station
Clinic

***Odraha*** VDC is situated just to the ***southern part*** of ***Tapeswari*** VDC in ***Saptari*** district. All 9 wards of the VDC are affected directly from the Reserve and the area covers about 571 ha. Of these 548 ha. of the land is used for ***cultivation***, 8.5 ha. for ***orchard*** and 14 ha. for ***rivers*** and ***sands***. The per capita distribution of land is 0.14 ha..

***Kamalpur*** VDC is also situated in ***Saptari*** district just to the southern part of ***Odraha*** VDC. The Reserve directly affects 8 wards of this VDC and are included in the buffer zone. Total area of this VDC is 535 ha. and possess 523 ha. ***Cultivated*** land, 10 ha. of ***orchard*** and 2 ha. is covered by ***rivers*** and ***sands***. The distribution of land is 0.12 ha. per capita.

The VDC of ***Ghoghanpur*** is situated in the western middle part of KTWR in ***Saptari*** district. There are 9 wards in this VDC, out of which 2 are highly affected by the Reserve and are kept in buffer zone by PPP. Total affected area of the VDC is 337 ha., where ***cultivated*** land is 306 ha, ***Orchard*** land 6 ha, and 1 ha. land for ***river*** and ***sand***. The per capita distribution of land is 0.18 ha. .

The VDC ***Pipra*** is situated almost parallel to the ***Ghoghanpur*** VDC in the *Middle Western part* of KTWR in ***Saptari*** district. All 9 wards of this VDC are close to the Reserve and are kept in buffer zone by PPP. Total area of this VDC is 624 ha, where 617 ha. is used for ***cultivated*** land and 7 ha. for ***river*** and ***sand***. The land distribution

per capita in the area is 0.14 ha.

***Jagatpur*** VDC situated in the southern part of ***Pipra*** and ***Ghoganpur*** VDC of ***Saptari*** district. All 9 wards of the VDC are affected from the wild life of Reserve and it includes the buffer Zone of PPP. The land occupies 584 ha of VDC and 561 ha is used for ***cultivation***, 18 ha for ***orchard*** and 5 ha for ***river*** and ***sands***. 1.0 ha of land is distributed per person.

***Badgama*** VDC is situated in far *southern part of western region* of KTWR in ***Saptari*** district. This VDC is also very close to the Reserve. Almost all (9) wards are included in the buffer zone by PPP. Total area of this VDC is 470 ha. where 462 ha. is used for ***cultivated*** land, 5 ha. for ***orchard*** and 3 ha. for ***river*** and ***sands***. 0.11 ha. land per person is used by the people of this VDC.

## AIMS AND OBJECTVES :

The work on people interaction in Koshi Tappu wild-life Reserve (KTWR) has been mainly focused on conflict between wildlife activities of Reserve and the neighbourhood or the people of buffer zone. The main conflict arises through the crop and livestock damage by wildlife, domestic livestock grazing, illegal harvest of fodder, illegal entry of domestic buffaloes for hybridisation, hunting, poaching, fishing inside the Reserve and annual harvest of grasses (thatches) by the people of buffer zone. The aims of the present study is as follows:

i. To assess the social and economic condition of the people

of the surrounding area after the establishment of National Reserve area.

ii. To assess the impact of presence of wild buffalo on the crops and livestock of buffer zone.

iii. To asses the possibility of improving the cropping pattern and change in the strategies of rearing of domestic animals for the betterment of their economic condition.

iv. To asses the solution of conflict between the authorities and the people of that area.

# REVIEW OF LITERATURE

# CHAPTER –2 REVIEW OF LITERATURE

Since this type of study started quite lately, the literature available is scanty. The studies related to park and people issues were carried out in ***Koshi Tappu Wildlife Reserve*** (KTWR) and have shown ***numerous problems***. The KTWR is the only wetland of Nepal. Its biodiversity was studied by several earlier workers. ***Shakya (1994)*** has broadly classified the *biological habitat* of KTWR into three groups, in terms of vegetation, which includes grassland, constituting 80.8%, wetlands 12.9% and forestland 6.3%. The Reserve covers almost 45% of total vertebrate fauna of the country. Basically, this Reserve was established for conservation of wild water buffalo, however it is also an important winter habitat of migratory water fowls as reported by ***Inskipp*** and ***Inskipp(1985), Heinen (1988).*** In the appendix 4, 5, 6, 7, 8 & 9, the checklist of mammals birds, fishes, Amphibians and reptiles, butterflies and vegetation is mentioned as reported by ***Inskipp (1989), Smith (1993), Suwal (1993), Shakya (1994) Bpp (1995a)*** and ***Baral (2000)***. It is also cited in 1998/IUCN as *"An Interpretation and Education System for* ***Koshi Tappu Wild Life Reserve*** *and its buffer zone"* ***(1998/ IUCN).***

## WETLANDS :

***Wetlands*** have been defined in a number of ways. ***Cowardin et al (1979)*** defined the wetlands as a transition between terrestrial and aquatic ecosystem, which was accepted by ***U.S fish*** and ***wildlife***

***service.*** This definition has been in wide use. Later, however, new concept was developed by ***Ramsar convention Bureau (1987)***. The wetland was defined as an area of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including area of marine water the depth of which at low tide does not exceed 6 meters.

The *wetland classification* given by ***Odum et al (1974), Miller (1976), Cowardin et al (1979), Scott (1989)*** classified the wetlands into 30 categories of natural wetlands whereas ***Dugan (1990)*** added nine manmade ones to the list. Wetlands in ***Nepal*** have been classified into 8 categories such as ***rivers, lakes, reservoirs, ponds, swamp, river floodplain, marshes*** and ***rice*** fields ***(Sah and Sah, 1999)***. The wetlands cover an area of 743,700 ha in ***Nepal*** (*Fisheries Development Division* ***(FDD),1992***).

***Howard (1992)*** reported that the ***flat areas of river valleys*** become flooded by river water when its flow exceeds the drainage capacity of its channels, it produces oxbows, flood plain lakes and back swamps. The Koshi Tappu is also a flood plain of ***Koshi River***. ***Jones et al (1989)*** explained the productivity of wetlands per unit area, as the highest of any ecosystems in the world. The primary productivity of lowland wetland run as high as 4,000 grams per square meter per year which is equal to that of tropical rain forests.

Several pieces of literature support the monetary and non-monetary values of wetlands. ***Jaworksi*** and ***Raphael (1978)*** analyzed

the cost benefit analysis of wetlands in the lake area of ***USA.*** ***Jaworski (1981)*** described the functional values of wetlands. ***Pandit (1991)*** studied the flood plain of the rivers of ***Jhelum*** and found that the base of ***Kashmir Himalaya*** provide about 0.2 million migratory waterfowl, which caused pollution on their periphery. ***Pandit (1984)*** also considered some species of waterfowl as the indicators of pollutions.

***Asian Wetland Bureau (AWB) 1991,*** studied the *biodiversity of wetlands* of ***Bangladesh.*** ***Page*** and ***Burr (1991)*** studied fresh water fishes of ***North America.*** Wetland supports higher species diversity per unit area than many other ecosystems. About 1,044 invertebrate species have been listed from a small German stream of approximately 1-m wide and 4.5-km long passing through meadow and woodland, ***(Allen and Flecker, 1993).***

The wetlands of ***Terai Nepal*** possess *117 species of* ***fish*** and *365 species of* ***birds*** have been listed from Koshi Tappu wetlands alone ***(Sah, 1997). Baral (2000)*** reported 461 bird species in KTWR. ***Edds (1986)*** has listed 131 species of fishes from RCNP. ***Inskipp (1988)*** reported 36 species of ***Amphibian in Nepal*** comprising 34 species of frogs and toads, and 2 species from mid hill wetlands of ***eastern Nepal*** only. ***Husak*** and ***Kvet (1990)*** and ***Thibodeau (1985)*** suggested about *wetland flora* of ***Nepal*** and its distribution. ***Sah (1997), Scott (1989)*** studied about the Forests, Macrophytes and most of vegetations of river flood plain of ***Karnali, Melamchi*** and ***Koshi River.***

In the context of Nepal, many botanists have concluded that the flora of *eastern part of Nepal* is not the same as that of the *western part* where as *central Nepal* has the elements from both. This is true for wetland flora also ***(Hara et al, 1978,79,82).***

***Sah*** and ***Sah (1999)*** reported that the *immigration of people* from the mountains during last 4 decades has led to the drainage of a number of wetland and their subsequent conversion to agricultural lands, causing a significant loss of wetlands with an adverse impact on the bio-diversity. This kind of problem has been experienced in developed countries also. Such a report was described by ***Mitchell (1992)*** from the 48 lower ***states of US***, whose loss was 60 acres of land every year between the 1980s and 1990s. Population densities, developmental pressure and consequent declination of forest area caused the disappearance of wetland and losses in the Bio-diversity value of such places ***(Sah*** and ***Sah, 1999).***

## BIO-DIVERSITY :

*The worst sin towards our fellow creatures is not to hate them, but to be indifferent to them; that's the essence of inhumanity.*

*George Bernard Shaw*

***Shrestha*** and ***Gupta (1993)*** reported the expected ***number of species*** on the earth, which is between ***5*** and ***50 millions***, of which ***1.4 million*** had been identified. Among these, approximately ***248,000*** are ***higher plants***, ***9000*** are ***birds*** and ***400*** are ***mammals***. The current decline of bio-diversity as a result of human activities

poses a serious threat to the endangered species of Reserve.

***IUCN (1993)*** expressed the view of a bio-diversity as variability among living organism. ***Denny (1993)*** has looked into 5 different perspective of *bio-diversity, namely precautionary perspective, moral perspective, indicative perspective, aesthetic* and *cultural perspective* and *economic perspective.*

As regards the ***species diversity of Nepal, Hadgson's*** scientific collection recorded in the *British Natural History museum* includes ***9,512*** *specimens of birds*, ***903*** *specimens of mammals* and ***84*** *species of reptiles.* About 127 papers have been written on these specimens ***(Bhandari, 1998).***

***Shrestha (1990)*** reported ***116*** *species of fish* in KTWR. Fifty thousand ducks at a time in mid February was reported by ***Scott (1998). Upreti (1992)*** had studied unique *Bengal rain forest of* ***Nepal. Baral (2000)*** reported ***461*** *bird species.* ***Shrestha*** and ***Gupta (1993)*** reported one new species of fish (i.e. *Calisa sota*) first time in Nepal. (Vegetation and fauna of KTWR are mentioned in ***appendix 4-9***).

***Hall*** and ***Francesca (2001)*** studied the movement and mortality of turtle (*Emydoidea blandingi*) at the wild life management area of ***Minnesota. Pitcher*** (2000) studied the green turtle in ***Saudi Arabia. Haemings (2001)*** proposed restoring the abundance of symbiotic nest protecting animals in habitats where birds face an increased risk from predators. This way, the birds there could increase their chances of reproductive success by nesting close to

these protectors. ***Gray*** and ***William (2000)*** had determined the effects of grazing on vegetation, avian abundance, species richness and reproductive success on pasture streams and associated riparian habitat in ***south west Pennsylvania***. Bird count, nest monitoring and vegetation sampling were used for his study. ***Serroni et al (1999)*** studied the ***herpetofauna*** of ***Calabrian wetlands.*** ***Kairu (2001)*** reported the use of wetland and impact on lake Victoria and solely concentrated river the arrangement issue of wetland in Kenya region. ***Shimada et al (2000)*** compared the number of birds in flooding year with those of normal year in birds community.

***Fairbairn et al (2001)*** had found that species occurance, species richness and density of nesting species were related to wetland habitat variables. If a species is of management concern, their factors that are associated with greater probability of occurance should be concerned when selecting sites restore to wetland condition. ***Syphard et al (2001)*** had expressed his view on the cause of loss of wetland area, and concluded that it was mostly due to agriculture and urban land uses. ***Askins (2001)*** has studied sustainability of bio-diversity on wetlands with the huge successfull communities of wetland. ***Keddy et al (2000)*** had studied the work on management and conservation of wetland in large lakes.

***Nepal*** has been a unique focus for the naturalist in studying nature, but the country remained almost completely closed to the western travelers until the political changes were brought out in 1951.

Its flora before that date was very little known. The earliest work on Nepalese flora was based on plant specimens collected by ***Hamilton (1801-02),*** and ***Wallich (1820-22)*** from the valley of Kathmandu and the areas enroute from the plains of ***Terai (Chaudhary, 1999).*** In the 19th century, the notable collections were those of ***Buskill (1907),*** and ***Polumin (1949) (Cited from Chaudhary 1999).*** Later ***Bhatt (1964), Banerji (1966) Numata (1965,1967) Kanai (1966, 1971), Hara (1966), Dobreme et al (1971), Stainton (1972) Oshawa et al (1973), Kanai et al (1975)*** etc. added to enrich the knowledge on the flora of Nepal. According to the Botanical survey, the total number of flora of Nepal being estimated as 7,000 by the ***British Natural History museum, London (Chaudhary, 1999). Stern (1960)*** and ***Banerji (1963)*** have proposed three divisions of flora of Nepal corresponding to the three big river systems ***Karnali***, Koshi and ***Gandaki. Swan*** and ***Leyiton (1962)*** described seven floristic zones based on its habitats. ***Stainton (1972)*** described the vegetation of Nepal on the grounds of ecology and composition of six divisions. ***Dobremey*** and ***Shakya (1975)*** and ***Shrestha (1976)*** have also studied in detail the vegetation of different sectors of Nepal.

***Grassland*** can also be managed for the *conservation of wildlife.* Conservationist ***Dashmann (1984), Machlis*** and ***Tichnell (1985) Zube (1986)*** had studied the ***National Park*** and protected areas in general. They concluded that the support, positive attitude and the perception of local people are the prime factor for the success of wildlife conservation. The grassland over grown by coarse grasses can be reclaimed and certain grassland biotopes or habitats, which is seen

ecologically desirable according to the perception of an individual conservationist.

KTWR is an excellent example of grassland Ecosystem ***(Thapaliya*** and ***Tiwari, 2000)***. Every year almost ***25000 to 35000 villagers*** participate in grass collection for 7 to 10 days. During winter the practice bettered the local economy. The main grass collected by the villagers is *Imperata cylindrica* ***(Thatch grasses)***. Fodder of live stock, medicinal herbs and edible plant are also harvested but it is not permitted by park authorities ***(Sah, 1997)***. Some officials would allow carrying the short firewood unofficially during grass cutting period that must not be longer than 2 feet ***(Thapaliya and Tiwari, 2001).***

Other important grasses were *Verteveria, zizanords, Phrogmites karka, Saccharums spontsneum, Typha anguistafalra,* where the savanna type of grass land creates an ideal habitat for the Asiatic wild buffaloes ***(Sah*** and ***Suselo 1996, Chaudhary, 2000)***

## WILD WATER BUFFALO (*Bubalus Bubalis*) :

***Encyclopedia mammals (1984)*** had clearly defined the wild water buffalo as ancestor of domestic buffalo. There are 6 varieties of wild water buffalo found on earth, one of which, *Bubalus bubalis,* is found in Koshi Tappu and is reported as endangered ungulates ***(Heinen, 1993a, BPP, 1995e). Thapaliya*** and ***Tiwari (2000)*** had mentioned that KTWR was specially created for the conservation of *Bubalus Bubalis.* Several researchers like ***Gupta*** and ***Mishra (1972),***

***Dahmer (1978), Bauer (1987), Heinen (1993a), Suwal (1993), Bhandari (1998),*** had studied the ecological and behavioral aspects of ***wild water Buffalo*** (*Bubalus bubalis*). The population of wild water buffalo is not constant; it is fluctuating mainly because of poaching, disease and the monsoon flood ***(Heinen, 2001).***

The ***wild water buffalo*** (*Bubalus bubalis*) resembles the domestic buffalo. It has heavily built body with a large head bearing a pair of horns curving towards the center of its head. The maximum weight of the wild water buffalo recorded in KTWR is around ***900 kgs***. Two types of horn have been noticed. One is the large, crescent shaped horn. The other type spreads out horizontally from head, curving upwards and inwards near the tips. The longest horn, measured from base to tip across the fore head, is 108 inches ***(275 cms).***

*The upper part of the body* of the wild water buffalo is ***flat*** with its *height* reaching almost ***2 meters*** at the shoulder. Its *black body* is sparsely covered with short hair. A white crescent on the lower part of the neck and white socks on all four feet up to the knees are its special characteristics. It also has a wide-expended hooves and short tail with white tassel ***(Sah, 1997)***.

The cross breeding between domestic and wild water buffalo threatened the genetic integrity of the latter. But ***Heinen (1993b)*** had believed that this is not a serious threat because adult males of

domestic buffalo are observed very infrequently on the Reserve. Hence, ***Heinen (1993b)*** assures that it is unlikely that a domestic male could monopolize a wild mixed herd in competition with a wild male.

The wild buffalo normally consists of ***20*** to ***35 heads*** in one herd, which was reported in KTWR. Adult male buffaloes march ahead to protect the entire herd and pass on an early warning signals to the rest of the herd in case of danger. They usually graze in the morning and evening, sometimes at the night they lay up under the high grass or dense patches of cover or in the pool during hot hours of the day. The female with a newly born calf is dangerous. Except for man, the tiger is the only enemy of the wild water buffalo. Even the tiger also runs away from the adult bull. The wild water buffalo has a good power of hearing, and its sight is moderate. A bull, under excitement, preliminarily stamps the ground with his feet before charging ***(Sah, 1997; Heinen, 1993, 2001)***.

The number of these endangered ungulates varies from year to year. It was 100 in 1945 ***(warden office)***, 63 in 1976 ***Dahmer (1978)***, 91 in 1987 ***Heinen (1993a)***, 93 in 1988 ***Heinen (1993a)***, 158 is 1993 ***Suwal (1993)***, and 145 in 2001 ***Heinen*** and ***Singh (2001)***. ***Heinen*** and ***Singh (2001)*** censussed wild buffalo in KTWR in March, 2000 using full count method (*previously discussed in the literature*). He estimated a population of 145 buffalo in addition to highly backcrossed, semi feral population of 131. Age and sex information was also recorded. The population has grown consistantly since earlier

censuses, but calf to cow ratios have declined and there new threats were identified. Human induced mortality has increased since previous work in Koshi Tappu. ***El Nahas et al. (2001)*** studied the chromosomes of *Bubalus bubalis*. ***Chaudhary et al (2001)*** studied the oral infection of wild water buffalo. ***Sukhato et al (2001)*** studied the improved procedure for cryo-preservation of wild water buffalo spermatozoa. ***Hasamani et al 2000*** studied the impact of feeding of wild water buffaloes. ***Srivastava*** and ***Malik (2001)*** studied the intra-muscular kinetics and dosage regimens for pralidoxine in buffalo calves. In his study the most appropriate dosage regimen for 2 PAM in the treatment of organophosphate in buffaloes would be 25 mg/Kg followed by 22mg/Kg at 8-hour interval. ***Das et al (2000)*** studied the nucleoside sequence of wild water buffalo. ***Nikolov (2000)*** studied the biochemical changes in cerebrospinal fluid, blood and rumen fluid of buffalo calves. ***Kumar et al (2001)*** studied the histo-morphology of buffalo calves. ***Sereno*** and ***Sereno (2000)*** studied the *Bubalus bubalis* and the main objective of this study was to observe the faeces of ***Nelore*** and ***Plataneiro*** breeds with buffaloes. The development of several species of flies specially *Haematobia irritans*. ***Ramadon et al (2001)*** studied the infiltration of different subsets of immune system cells in the ovarian Parenehyma of Egyptian Buffaloes. ***Palta*** and ***Chauhan (1998)*** studied the embryonic development of wild water buffalo (*Bubalus bubalis*). ***Singh*** and ***Ludri (2001)*** studied the variation of somatic cell count (5c.c.) in milk of buffaloes as influenced by the milking time, stage of lactation, purity and season. ***Di Meo et***

***al (2000)*** studied the chromosomes of *Bubalus bubalis*. ***Rautian et al (2000)*** studied the morphological and genetical differentiation between bull and wild water buffaloes.

***Tiwari et al (2001)*** studied the biochemical constituents of blood and rumen fermentation pattern of growing buffalo calves fed ammoniated wheat straw based rations supplemented with three different protein supplements. ***Vidyarthi*** and ***Kurar (2001)*** studied the nutrient utilization and influence of dietary butyrate on the health of *Bubalus bubalis*. ***Ahmed*** et al ***(2001)*** studied the potential antigen of *Bubalus bubalis*. ***Kumaresan*** and ***Ansari (2001)*** studied the semen quality of wild water buffaloes (*Bubalus bubalis*). ***Molmar et al (2001)*** studied the prevalence and brucellosis in *Bubalus bubalis*.

BUFFER ZONE :

Outside the boundary of the Reserve is the buffer zone. This is the area that is directly affected by wild life. The buffer zone area of Reserve includes ***12,622/ha*** of *cultivated land* and about 9000 families as reported by ***DNPWC (1998; 2001/PPP)***. The resource profile of Koshi Tappu Wildlife Reserve and proposed buffer zone focuses mainly on the map showing forest, grassland, KTWR and proposed buffer zone boundary, road and trail network, drainage distribution, annual rainfall, land use etc. Report of the resource profile shows the flexibility of changes of land pattern in the flood plane of KTWR within 14 years ***(1978-1992).*** This document supported the changing pattern of the land of the flood plain.

***Milton*** and ***Binney (1980)*** reported on conflicting issues of wildlife conservation and agricultural land use in ***Padampur*** VDC of ***Chitwan*** district. They found that the crop loss by wildlife was the main problem in the neighbourhood of the park. This study in ***Chitwan*** identified three zones of crop-damage by wildlife: amounting 50% to 100% loss. On such issue, the Government should work on the resettlement of the adjoining areas or provide some compensation. They further documented that some farmers, particularly those possessing land adjoining the RCNP grasslands, stopped cultivating their lands because of the wildlife menace. ***Rhino, deer, wild boar*** and ***parakeet*** are the significant threat to the economy of the people of ***Padampur*** VU for their subsistance.

***Berkmuller*** and ***Mukherjee (1990)*** gave the concept of people's participation in buffer zone for the management of park. The multiple use area has been applied quite successfully in ***African countries***. With the support of these views, ***Machils*** and ***Tickneu (1985); Sharma (1986)*** had given the views for long-term stability of parks in developing countries.

***Edson et al (1988)*** carried out the study by analyzing the current fuel wood pattern in the adjacent villages of the park. The fuel wood supply from the adjacent forest areas of park would be totally depleted within the next 25-30 years. The same trend is shown in area of ***Bachhouli*** V.U of RCNP.

*United Nations Educational, Scientific and Cultural Organization*

periphery from Koshi barrage to ***Rajbas*** of ***Sunsari*** district in the east and Koshi Barrage to ***Trijuga*** river bank in the ***Tapeswari*** VDC of ***Udayapur*** District. The Koshi wetlands are used mainly for *irrigation, fishing, grazing, religious purpose, household purpose, fodder, transport* and *harvesting* plant resources. Out of 16 buffer zone VDCs, 11 VDCs are directly using relatively more resources of the Reserve, ***(IUCN, 2002)***.

***DNPWC/ PPP (2000)***, had reported the 421 ha in eastern region and 16 ha in western region with the depth of 0.5 to 2 m distributed as pond and lakes of BZ. Besides the ponds and the lakes, all lands in buffer zone are used as the crop land of buffer zone ***(Sah, 1997).***

## ECO-TOURISM :

***Inskipp*** and ***Travis (1967;*** cited by ***Jha, 1999)*** have discussed the advantages of an alternative form of mass tourism movements and activities. Their view on alternative tourism has grown largely out of the host nation's desire to avoid the undesirable impact of the industry. However, unless the requirement of safeguarding the environment is met, eco-tourism is in danger of being a self-destructive process destroying the very resources upon which it is based ***(Jha, 1999)***.

The tourism in Nepal is rather recent in origin. Before 1950 no foreigner was allowed to visit Nepal without permission of ***Rana rulers***. The motion of Eco-tourism was initially developed in ***"1987"***

by ***Ceballous Laseurau.*** He defined Eco-tourism as experience of "travelling to relatively undisturbed areas with the specific objectives of studying, admiring and enjoying the scenery and its wild plants and animals as well as any existing cultural manifestations found in these areas." ***Ceballous*** defined the Eco-tourism confined to the objective of travelling and the area (region) traveled for ecological observation of nature.

Eco-tourism protects natural community's importance to our survival and viability. Eco tourism activities typically will involve local inhabitants in order to ensure long-term success and the eco- tourism required strict management. The emphasis is more on quality of experience, education and conservation of resources at the destinations ***(Jha, 1999)***.

The concept called ***Eco-tourism*** has emerged as a replacement to mass tourism as a way to reduce adverse impact on nature. Eco-tourism is a response to the negative effect that mass tourism has had on the culture and geography of countries. In reality, Eco-tourism is a culturally and environmentally sensitive travel that contributes to conservation and management of natural areas for sustainable economic development. Eco-tourism is a catchword that means many things to many people. It means ecologically sound tourism. Eco-tourism is a nature travel that advances conservation and sustainable development efforts. It seems that the development of Eco-tourism concept has led to a concept based on the desire to ideal tourism.

About 25% tourists visit NP and wild life Reserve in Nepal. In

1993 RCNP was visited by 57, 603 (i.e. 27.4 percent of total tourist in Nepal) and generated half a million dollars. This National Park is designated as world National Heritage (WNH) site, received about seventy percent of Eco tourist in Nepal. Eco-tourism is sometimes called as natural tourism, which means to travel the places of natural attraction that contributes to their conservation; integrity of local communities and ethnic group. There are 8 national parks, 4 wildlife Reserves, one hunting Reserve and 3 conservation areas covering 15% of its valuable land. The total number of Eco tourist in KTWR was 488 during 1995-1996 ***(Jha, 1999)***.

***Loubser et al (2001)*** studied the eco-tourism of ***Namaqua National Park*** on the aspect of planning and management. ***Li*** and ***Han (2001)*** carried out some works on management of eco-tourism in natural reserves of China. ***Duchesne et al (2001)*** observed the flow of eco-tourist in ***Charlevoix Biosphere*** reserves in ***Canada*** and suggested for the flow of eco-tourist in winter. ***Hussain (2000)*** has carried out the partnership programme between local farmers and private enterprise in the form of an insurance scheme combined with eco-tourism activities. He studied the survival of snow leopard as a unique species of ***Baltistan*** for the flow of eco-tourist.

## PARK –PEOPLE CONFLICT :

Conflict between the park and people of neighbourhood has been observed since the establishment of National Park, Wild Life Conservation and Reserve areas at ***Kusaha***. From the park, in one hand the wild animals get entry in the fields of local people. In the

other hand local people's livestock frequently enter inside the park for grasses. People from the buffer zone also utilize the wood and other resources of their need from the Reserve. Several National Parks, Reserve and Conservation areas of country are suffering from such problems. The proper management of every protected area requires the mobility, consciousness, and awareness of the people outside the park for its sustainability. The present author feels that the co-operation of the people outside the park is an essential factor.

The conflict arises due to the crop damage, fishing and hunting, encounter between man and wild life, fishing, hunting and poaching ". ***Laurie (1982)*** reported in his thesis " *Ecology* and *behavior* of the one horned rhinos. Area bounded 1500 m from the forest edge was damaged negligibly. In his study, he estimated that 52 rhinos were living around *Royal Chitwan National Park* ***(RCNP)***.

***Milton*** and ***Benny (1980)*** found that the interference of wildlife on crop was the main problem of inhabitants of ***Padampur*** VDC and *Royal Chitwan National Park* ***(RCNP)***. They found that the crop damage ranged from 50 % to 100% in this area. A survey was carried by ***DNPWC/IUCN (1988)*** on rhinos in ***RCNP***. Livestock contributes to economic sources of the local people in ***RCNP***, which contribute 28% in agricultural production ***(Sharma 1991)***. Most of the livestock graze inside the park and government forest. The local people have only limited land for agricultural activities and they have no land for grazing their livestock.

In 1986, ***Sharma*** conducted a three-month study to provide a more comprehensive picture of the conflict issue between park neighbours and RCNP. He argued for more logical approach to park management in which RCNP surrounding had developed an ***"Impact Zone"*** for community forestry programme. This programme increased the available resources of adjacent areas ***(Sharma, 1986:1990).***

***Kharel (1993)*** has studied about the conflict between Langtang National Park and local people living around the park boundary. The conflict started when the park was established and formal rules were launched to protect its resources. This has caused a loss of benefits to them and is the source of conflict.

***Nepal*** and ***Weber (1993)*** have studied the park people relation in RCNP and its adjoining areas. They found that there was park-people conflict namely about illegal extraction of park resources by people, live stock grazing, hunting, fishing and crop damaging by wild animals.

***Shrestha, 1994*** studied the status of park and people relation in the villages of ***Bardeni, Sauraha, Padampur, Bajhmada VDC*** and adjacent to RCNP. She found that crop damage and harassment was due to the park animals and illegal activities. Illegal use of forest resources, poaching, hunting and fishing inside the park was the main causes of conflict between park and people.

***Upreti (1985)*** stated that human wild life interaction antipathy towards the park and illegal resources extraction are the main reasons

of conflict between the park and people. He also suggested some measures to solve their problems such as access to park and Reserve, economic incentive, development schemes, conservation education and management of total landscape in the region.

***Nepal*** and ***Weber (1992)*** in the book ***"Struggle for Existence"*** pointed out that the cattle lifting by tiger is a wide spread phenomenon along the border of park and Reserve. According to their study in RCNP out of 153 large animals killed by the tigers where one –third were livestock.

Similarly ***jackal, fox, black bear*** etc also create trouble to livestock. Such types of incidents are also major source of conflict. The conflict rises mostly due to restriction put forward to people in using the resources which they were using formerly. Several studies on park people interaction stated that the conflict arises due to reaction from the social and cultural intervention from the out side.

***Sharma (1991)*** reported that in the hills of Nepal livestock provides 27% of the total income, while at household level it can generate just 20% economy. Livestock make cash income to household more than the agricultural crops. So there is greater tendency to keep livestock.

Similar study referred to livestock killing by wildlife in the village near ***Royal Bardia national park***. It was reported that the villages bordering the park lost more of their livestock than that of the village not bordering the park.

***DNPWC (1998) of Makalu Conservation Areas*** has estimated the volume of crop damage and the main depredating wild animals. It has also suggested the way to reduce the problem of the conflict between people and wild life. According to the report, the main depredators were ***Himalayan black bears, deer, wild boars, monkeys*** and ***varieties of birds***. The rate of crop loss exceeded 50% along the edge of the park due to those wild animals. The report also suggested the method to control crop loss by establishment of crop damage zone and paying of compensation to people for crop losses.

***Sharma (1991)*** studied the conflict between ***Royal Chitwan NP*** and the local people and found that the conflict was raised due to the lack of knowledge of local people towards the bio-diversity and nature conservation. The main thing is their dependency on forest resources for fodder and fuel.

***Heinen (1993a)*** studied the park people conflict in the KTWR and stated that poor socio-economic condition has created the conflict between neighbourhood and Reserve. He found that poaching, firewood collection and timber cutting affects the Reserve. The important trouble creators are ***wild water buffalo, spotted deer, wild boar*** and ***jackal.***

***Shrestha (1997)*** in his book ***"Mammals of Nepal"*** elaborated the ecology and behaviors of mammals of ***Himalayan foothill***. He estimated the existing population and their environment as well as suggested conservation measures needed.

***Penafiel (1996;*** cited by ***Jha, 1999),*** in the study carried out in the ***EL Nido*** Reserve in the ***Philippines***, found that friction between the management staff and the local people began developing due to enforcement of penalties on local residents and fishermen for illegal activities in the Reserve. ***Njifort*** and ***Tchamba (1991)*** carried out similar study in the villages around the ***national park of Faro***, ***Benore*** and ***Boube, Njida*** in ***northern Cameroon***. They found out that the park management had largely ignored the local people's need and interest and they had not been involved in management and planning of the park. The population pressure and crop damage in the adjoining area was the main cause of conflict. Live stock predation by wild animals and attacks on local people had combinedly fuelled the conflict ***(cited by Jha, 1999).***

According to ***Thapaliya*** and ***Tiwari (2000)***, the conflict between the local people and KTWR authorities raised because of the restriction posed by government to the local people in using the resources of this Reserve for their daily requirements and misbehaviour of Reserve authority. Destruction of cultivated crops of the local people by the wild animals of Reserve created the situation of conflict. Most of the people living on fishing, which has also been prohibited, caused conflict. Due to dual ownership of land inside, no proper compensation was given to the people of buffer zone. This was also a cause for conflict. ***Sah (1997)*** stated that the conflict between Reserve only in KTWR and local people was due to grazing of wild

buffalo in the farms and also due to grazing of livestock within the Reserve. He also listed the dual ownership of land in the Reserve by local people and Reserve authority as the main cause of the conflict. There was less rangeland so the cattle graze inside park also causes the conflict between Reserve authority and local people.

***Shrestha (1994)*** and ***Upreti (1985)*** identified park regulation, crop damage, and live stock depredation and loss of human life as source of conflict in RCNP.

# EXPERIMENTAL METHODOLOGY

# Chapter–3 EXPERIMENTAL METHODOLOGY

The methodology for the study of the problem was adopted from ***Sharma (1991)*** and ***Heinen (1993)*** *viz* :

*i.* ***Questionnaire survey***

*ii.* ***Frequent field observation***

*iii.* ***Systematic survey***

*iv.* ***Monitoring the livestock grazing***

*v.* ***Participatory Rapid Appraisal (PRA)***

## 1. QUESTIONNAIRE SURVEY :

This type of survey was conducted in the VDC's which were 0.5 to 15 Km away from the Reserve area during Jan. 1999-July 1999. This selection of settlements close to wild life Reserve was primarily done because of relatively more wild life or wild water buffaloes (***Bubalus bubalis***) depredation occurs in such area. The ***HH*** (*Household*) of this area has been chosen randomly for the survey, 5 to 10 sample households were taken from each *village development committee* ***(VDC)*** of ***Sunsari, Saptari*** and ***Udayapur*** District.

The questionnaire focuses mainly on the influence of wildlife to the general life pattern, problem faced by the wild life, especially by the wild water buffaloes *Bubalus bubalis* and relationship with Reserve staffs ***(Warden office staff*** and ***Army staff)***. The crop damaging records show influences on the socio-economic condition of

the people and the interaction of Wild Life Reserve; whether it is positive or negative ***(Appendix 1-2)***. Questionnaires consisted of both close ended and open-ended questions. Park authority and leader of *village development committee* ***(VDC)*** were interviewed with open-ended question for the collection of detailed information. Hence, the survey had been done on two aspects, viz:

i. Survey for general information and

ii. Survey for socio-economic condition.

## 2. FREQUENT FIELD OBSERVATION:

Depredation from the wild life was closely monitored in the focal area, time to time ***(Feb 1999 – Sept 2001)***. *Babalus bubalis* damaged most of the crops in focal area. Enquiry about the crop production, damage by the wild water buffaloes and other wild life was also undertaken. Varying size and types of crops within the plot of focal area were recorded. The local people frequently did crosschecking of the productivity.

## 3. MONITORING THE DAMAGES CAUSES BY WILD LIFE :

The crop and livestock loss caused by wild life were monitored from the focal area by using elephants. This loss was determined by estimating the damaged area and the amount of the crop damaged. The damage of crops was caused mainly by the wild water buffaloes (*Bubalus bubalis*) and the rest of others had damaged least. Average loss of livestock was also calculated by monitoring the focal area of the

buffer Zone. Frequent entrance of livestock inside the Reserve has been monitored in times of different field visit. Damage of crop by few herds of wild water buffaloes was also observed and the damage of crops by them was also monitored time to time within two years from ***(Feb 1999 to Sep 2001)***. Some farmers of the buffer zone were also trained in making simple visual estimates of crops damaged by wild animals and in recording information in the standard form.

## 4. THATCHES (*Imperata cylindrica*) GRASS CUTTING SURVEY :

A systematic survey was conducted for 10 days in January 2000 during the period of grass cutting as permitted by KTWR. A total of 100 grass cutters were randomly provided the questions for interview. There were 8 official entry points into KTWR: 4 from ***Sunsari***, 3 from ***Saptari*** and 1 from ***Udayapur*** district. But they have made many entry points due to open boundary. A detailed field survey has been done from each entry point of Reserve. The 1st survey was solely conducted within the question format. It was conducted from ***Dec.1999 to 7th Jan 2000*** for 10 days. Interviews were conducted and at the time of entry, coupons were sold. The survey covered 8 official entry points. Interviews conducted during a single day covered two entry points. However, at times, only a single entry point was surveyed. The entry coupon was distributed before a day with the cost of NRS. 5 for each house hold. This methodology for grass cutting survey was based on ***Sharma (1991)*** for park people interaction in RCNP. Format of questionnaire was in Nepali.

## 5. THE PRA (PARTICIPATORY RAPID APPRAISAL) :

This technique based on Joachim and Heather, ***Grady 1991***, ***(July 2000- Nov 2000)*** was used for knowing the fluctuation of wild water buffalo (*Bubalus bubalis*) in KTWR.

### 5 a. KEY INFORMANT INTERVIEW:

A key informant is one who has special knowledge on *Bubalus bubalis* and such a person was picked up from buffer zone. For interview a teacher was picked up from each village development committee of buffer Zone. The data were crosschecked by interviewing politicians of respective VDC.

### 5 B. FOCUS GROUP DISCUSSION:

Problem of fluctuation of *Bubalus bubalis* population was thrown to the group of 4-8 person and they themselves brought out solutions through group discussion. For such tool, two groups were taken from each VDC for finding the proper solution.

### 5 C. GROUP INTERVIEW:

Few questions were raised in-group for the particular problems. Their views on the problem should be used for finding proper solution. Such type of questionnaire had been used for one group from each VDC of buffer Zone. The five techniques stated above were used for primary data collection.

### SECONDARY DATA COLLECTION :

Most of the secondary data were used for comparison, and knowing the bio-diversity inside. Mainly, the secondary data include records and reports from different sources and offices on the different

aspect of study. The checklist of bio-diversity and natural resource management unit reports from ***IUCN*** were used for knowing the flora and fauna inside ***KTWR***.

To study the biodiversity inside and outside of Reserve as well as to find out the activities of livestock and their population in BZ reference were made to Central bureau of statistics (CBS) of *Bio-diversity profile projects* ***(BPP)*** reports of ***HMG of 1995***.

Several maps, photographs, sources of articles, books, and research publications on the related topics have also been included in the secondary data of the study. Most of the information was taken from old people and senior citizens of the village, warden's office, Army office and intellectuals who helped to make the study fruitful. ***DNPWC***, ***IUCN, PPP,*** had also helped greatly to provide a secondary data.

## STATISTICAL ANALYSIS :

The data collected by using various methodologies adopted for varieties of information from the people of the buffer zone were analysed and compared with the observation of the previous workers. The information collected from the people regarding their reaction and the interaction with the wildlife and the plant grazing in the KTWR, which are directly, or indirectly affecting the life of the general people in the buffer zone were noted.

The data of the present study has been tabulated, statistically analysed (percentage, standard deviation, Chi square test, T-test, correlation coefficient and regression analysis) and graphically represented on chapter 4. For such analysis, 100 samples were taken randomly from 12 VDCs.

# OBSERVATION

# CHAPTER - 4 OBSERVATION

## QUESTIONNAIRE SURVEY :

Observation is based on questionnaire survey from the 12 VDCs. In the present study the factors taken are about the population growth, cropping pattern, bio-diversity and its damages in the buffer zone of forest reserve.

Table 1a and 1b showing the ***population, no of households, sex ratios, average population and C.V.*** in the census 1991 and 2001 study.

**Table 1a.**

| 1991 census | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Average Pop | | CV of Pop | |
| SN | V.D.C. | District | Tot. Pop | % of tot (Pop) | Household | % (HH) | Male | Female | Male | Female |
| 1 | Tapeshwori | Udaypur | 7195 | 10.47 | 1321 | 10.77 | 391.78 | 407.67 | 37.98 | 36.50 |
| 2 | Haripur | Sunsari | 6499 | 9.46 | 1240 | 10.11 | 384.89 | 337.22 | 38.66 | 44.12 |
| 3 | Kushaha | Sunsari | 7921 | 11.53 | 1410 | 11.49 | 464.22 | 415.89 | 32.05 | 35.77 |
| 4 | Shripur | Sunsari | 9612 | 13.99 | 1524 | 12.42 | 546.89 | 521.11 | 27.20 | 28.55 |
| 5 | Madhuban | Sunsari | 5737 | 8.35 | 1039 | 8.47 | 323.33 | 314.11 | 46.01 | 47.37 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Prakashpur | Sunsari | 11110 | 16.17 | 1987 | 16.20 | 622 11 | 612.33 | 23.92 | 24.30 |
| 7 | Jagatpur | Saptari | 3699 | 5.38 | 662 | 5.40 | 206.33 | 204.67 | 72.11 | 72.69 |
| 8 | Ghoghanpur | Saptari | 3858 | 5.61 | 703 | 5.73 | 214.89 | 213.78 | 69.24 | 69.60 |
| 9 | Pipra | Saptari | 2746 | 4.00 | 509 | 4.15 | 183.67 | 121.44 | 81.01 | 122.51 |
| 10 | Odraha | Saptari | 3445 | 5.01 | 652 | 5.13 | 187.89 | 194.89 | 79.19 | 76.34 |
| 11 | Kamalpur | Saptari | 3607 | 5.25 | 671 | 5.47 | 199.89 | 200.89 | 74.43 | 74.06 |
| 12 | Badgama | Saptari | 3287 | 4.78 | 550 | 4.48 | 183.33 | 181.89 | 81.15 | 81.80 |
| | **Total:** | | 68716 | 100 | 12268 | 100 | 3909.22 | 3725.89 | | |



$$\text{NB. \% (HH)} = \frac{\text{no of households in each VD}}{\text{Total households}} \times 100$$

$$\text{\% (Pop)} = \frac{\text{Population in each VDC}}{\text{Total population}} \times 100$$

$$\text{Average Male Pop} = \frac{\text{Total Male Population}}{9}$$

$$\text{Average Female Pop} = \frac{\text{Total Female Population}}{9}$$

NB - One VSC Constitute 9 WARDS

# Table 1b.

| 2001 recorded | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Avg Pop | | | C V | | | % Increase in 10 years | | | Sex ratios difference in 10 years | | |
| SN | V D C | District | Tot Pop | %of tot (Pop) | Household | % (HH) | Male | Female | Male | Female | Pop | HH | Male | Female |
| 1 | Tapeswari | Udaypur | 9930 | 10 60 | 2729 | 16 63 | 555 56 | 547 78 | 26 78 | 27 16 | 38.013 | 107 | 164 | 140 |
| 2 | Haripur | Sunsari | 8364 | 9 50 | 1560 | 9 51 | 480 56 | 448 78 | 30 96 | 33 15 | 28 697 | 25 8 | 96 | 112 |
| 3 | Paschim Kuhsaha | Sunsari | 9853 | 11 19 | 1580 | 9 63 | 554 89 | 539 89 | 26 81 | 27 56 | 24 391 | 12 1 | 91 | 124 |
| 4 | Shreepur | Sunsari | 12802 | 14 54 | 1898 | 11 57 | 738 11 | 684 33 | 20 16 | 21 74 | 33 188 | 24 5 | 191 | 163 |
| 5 | Madhuwan | Sunsari | 7429 | 8 44 | 1294 | 7 89 | 412 33 | 413 11 | 36 08 | 36 01 | 29 493 | 24 5 | 89 | 99 |
| 6 | Prakashpur | Sunsari | 13662 | 15 52 | 2705 | 16 48 | 726 00 | 792 00 | 20 49 | 18 79 | 22 97 | 36 1 | 104 | 180 |
| 7 | Jagatpur | Saptari | 4838 | 5 49 | 760 | 4 63 | 280 22 | 257 33 | 53 09 | 57 82 | 30 792 | 14 8 | 74 | 52 7 |
| 8 | Ghoghanpur | Saptari | 5031 | 5 71 | 932 | 5 68 | 273 67 | 285 33 | 54 37 | 52 14 | 30 404 | 32 6 | 59 | 71.6 |
| 9 | Purba Pipraha | Saptari | 3666 | 4 16 | 631 | 3 85 | 207 89 | 199 44 | 71 57 | 74 60 | 33 503 | 24 | 24 | 78 |
| 10 | Wodraha | Saptari | 4175 | 4 74 | 773 | 4.71 | 225 00 | 238 89 | 66 12 | 62 28 | 21.19 | 18 6 | 37 | 44 |
| 11 | Kamalpur | Saptari | 4707 | 5 35 | 828 | 5 05 | 269 33 | 253 67 | 55 24 | 58 65 | 30.496 | 23 4 | 69 | 52 8 |
| 12 | Badgama | Saptari | 4192 | 4.76 | 720 | 4 39 | 233.11 | 232.67 | 63 82 | 63 95 | 27.533 | 30.9 | 50 | 50 8 |
| | **Total:** | | 88649 | 100 | 16410 | 100 | 4956 67 | 4893 22 | | | | | | |

$$\text{NB: CV of Male Pop} = \frac{\text{Standard Deviation of Male Pop}}{\text{Average Male Pop}}$$

$$\text{CV of Female Pop} = \frac{\text{Standard Deviation of Female Pop}}{\text{Average Female Pop}}$$

$$\text{Percentage increase of pop} = \frac{\text{Pop of 2001 - Pop of 1991}}{\text{Pop of 1991}} \times 100$$

$$\text{Percentage increase of HH} = \frac{\text{HH of 2001 - HH of 1991}}{\text{HH of 1991}} \times 100$$

From ***table 1a*** and ***1b***, it is clear that number of households in ***1991*** has increased in ***2001*** by ***5463 (49.9%)*** and the population increased by ***27128 (49.9%).*** The maximum population and minimum population in ***1991*** census correspond to ***Prakaspur 11110 (12.53%)*** and ***Pipra 2746 (3.1%)*** respectively. The maximum households in ***1991*** also correspond to Prakaspur ***1987 (16.2%)*** and ***Pipra 509 (4.1%)*** respectively. Similarly, maximum and minimum population in ***2001*** corresponds to the same VDCs by ***13662 (15.4 %)*** and ***3666 (4.1%)*** and households ***2705(16.5%) & 631 (3.85 %)*** respectively. The population increased maximum of ***38.013%*** in Tapeshwori VDC and minimum ***21.19%*** in ***Odraha*** VDC from ***1991*** to ***2001***.

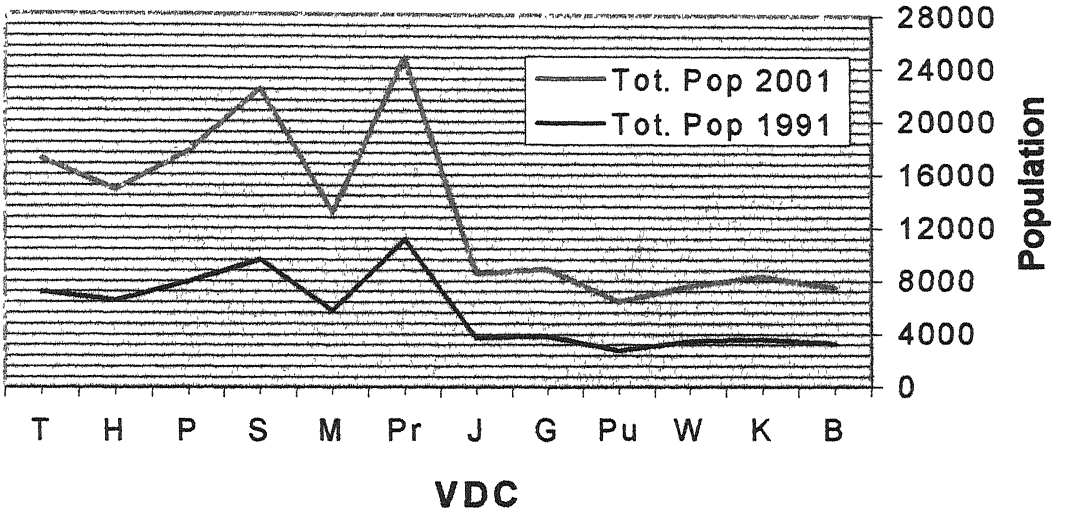
The maximum and minimum male population in ***1991*** was in ***Prakashpur*** and ***Badgama*** VDC respectively. The female population also was maximum in ***Prakashpur*** and minimum in ***Pipra***. Like wise the maximum and minimum average male population in ***2001*** were recorded in ***Shripur*** and ***Pipra*** respectively. The maximum and minimum female population also recorded in ***Prakashpur*** and ***Pipra*** in ***2001***. The least C.V. for male and female population in ***1991*** census corresponds to ***Prakashpur*** in both cases. Similarly, the least C.V. for male and female population in ***2001*** corresponds to ***Shripur***

and ***Prakashpur*** VDC respectively. The CV indicates that the population of male & female is more consistent in ***Prakashpur.***

VDC in ***1991*** and ***Prakashpur*** and ***Shripur*** in ***2001***. Higher the C.V. higher is the heterogeneity and vice versa.

***Line graph showing trend of populations in 12 VDCs in 1991 and 2001.***

**Fig.**




***Line graph showing sex ratios in 1991 and 2001.***

**Fig.**

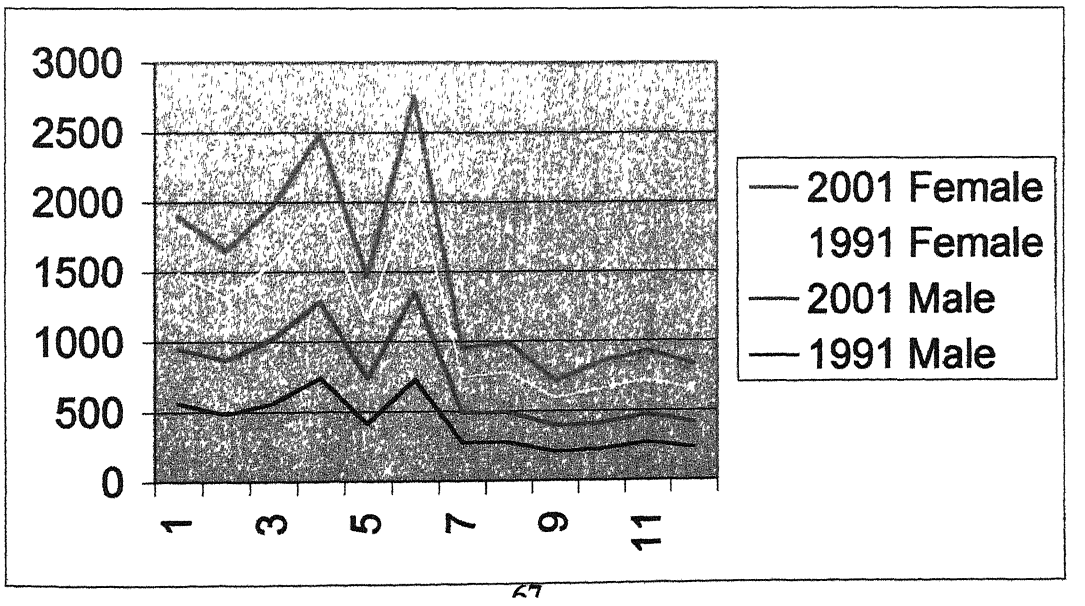


***Table 2*** showing the various crop grown in the 12 adjoining VDCs of the reserve area viz. ***paddy, wheat, millet, maize*** etc, bighas under various crops with their production

**Table 2.**

| SN | Crop | Total Land Under Crop (bigha) | Production (quintals) |
|---|---|---|---|
| 1 | Paddy | 903 | 22500 |
| 2 | Wheat | 413 | 3304 |
| 3 | Maize | 227 | 2215 |
| 4 | Millet | 30 | 119 |
| 5 | Potato | 45 | 605 |
| 6 | Sugarcane | 95 | 1650 |
| 7 | Mustard | 66 | 175 |
| 8 | Vegetable | 75 | 94 |
| **Total:** | | 1854 | 30662 |
| **Average:** | | 231.75 | 3832.75 |
| **S.D.** | | 280.57 | 7138.76 |
| **C.V.** | | 121.46 | 186.25 |

***NB.*** 1.5 bigha = 1 hectare
1 acre = 0.405 hectare

From ***table 2***, average land per crop is ***280.574 bigha (381.48 acres)*** and the average production per crop is ***3832.75 quintals***. The coefficient of variation for total land under crop is ***121.46%*** and that of production is ***186.25%***. This indicates more variations in the production than the area i.e. fertility of land varies accordingly.

***Circle diagram showing various crop area.***

**Fig.**

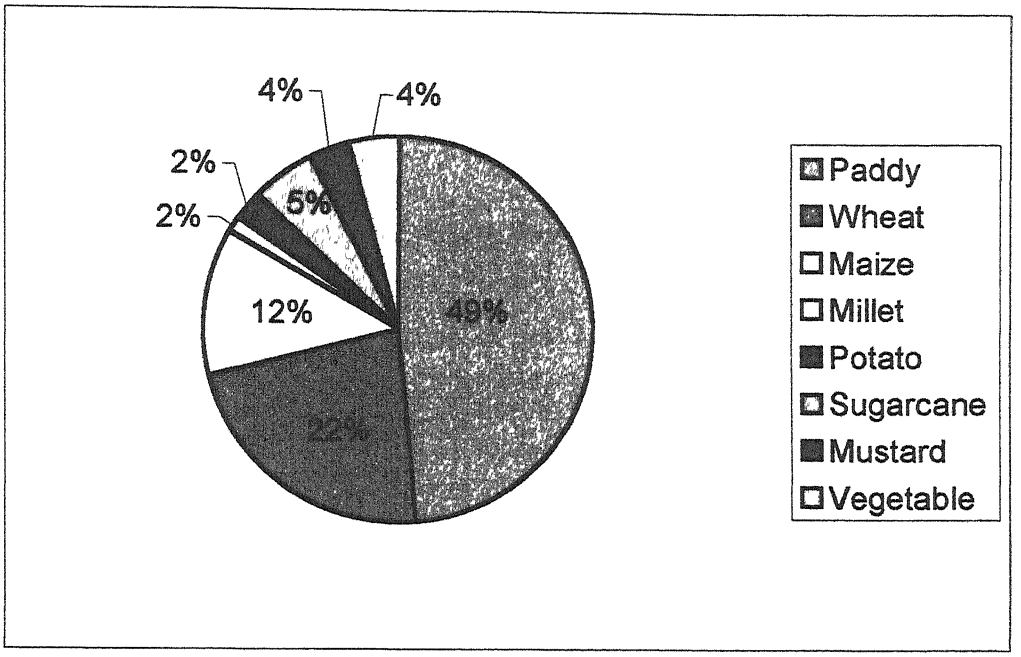



Table 3 showing the damage done by wild animals in the VDCs of various distances.

**Table 3.**

| SN | Distance (Km) x | Damage (%) Y | xy | $x^2$ | $y^2$ |
|---|---|---|---|---|---|
| 1 | 0-1 | 70 | 70 | 1 | 4900 |
| 2 | 1-3 | 55 | 165 | 9 | 3025 |
| 3 | 3-5 | 50 | 250 | 25 | 1444 |
| 4 | 5-7 | 38 | 266 | 49 | 900 |
| 5 | 7-9 | 30 | 270 | 81 | 576 |
| 6 | 9-12 | 24 | 288 | 144 | 225 |
| 7 | 12-15 | 15 | 225 | 225 | 13570 |
| | **Total:** | 282 | 1534 | 534 | 24640 |

**From Table 3:**

Correlation Coefficient between distance and damage is:

$$r = \frac{n\sum xy - (\sum x)\times\sum y)}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{(7\times 1534 \; - \; 52\times 282)}{(7\times 534 - (52)^2]\,½\,[7\times 13570 - (282)^2]\,½}$$

$$= \textbf{- 0.098}$$

This indicates that there is a high degree of negative correlation between distance and damages i.e. the closer the distance the more percentage of damage may be. To estimate the percentage of damage, consider the regression equation of damage on distance.

$Y = a + bx$

Where a, b can be computed by

$$b = \frac{n\sum xy - (\sum x)\times\sum y)}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{(7\times 1534 \; - \; 52\times 282)}{(7\times 534 - (52)^2}$$

$$= - 3.8$$

$a = [\Sigma y - b\Sigma x]/n = 282-(-3.8)52 = 68.51$

$\therefore Y=$ **68.51 – 3.8x**

This equation predicts the percentage of damage for a given distance. To test whether the distance and damage are uncorrelated:

Null hypothesis: $H_0$ : the damage is uncorrelated with the distance

Alternative hypothesis: $H_1$ : damage is correlated with distance

Under null hypothesis, the test statistic is

$$t = \frac{r(n0-2)^{1/2}}{(1-r^2)^{1/2}} \sim t_{n-1} \quad \frac{(-098(7-2)^{1/2}}{[1-(0.98)^2]^{1/2}} = -11.01$$

$|t| =$ **11.01**

The value of $|t|$ is highly significant with tabulated value of t at 1% level of significance for 7 – 2 = 5 degree of freedom i.e. $t_{0.005, 5}$=3.365.

Therefore, null hypothesis is rejected strictly and this indicates that the damage is highly correlated with the distance of the surrounding.

The ***bar graph*** shows the relation between distance of land and % damage by wild animals.

**Fig.**

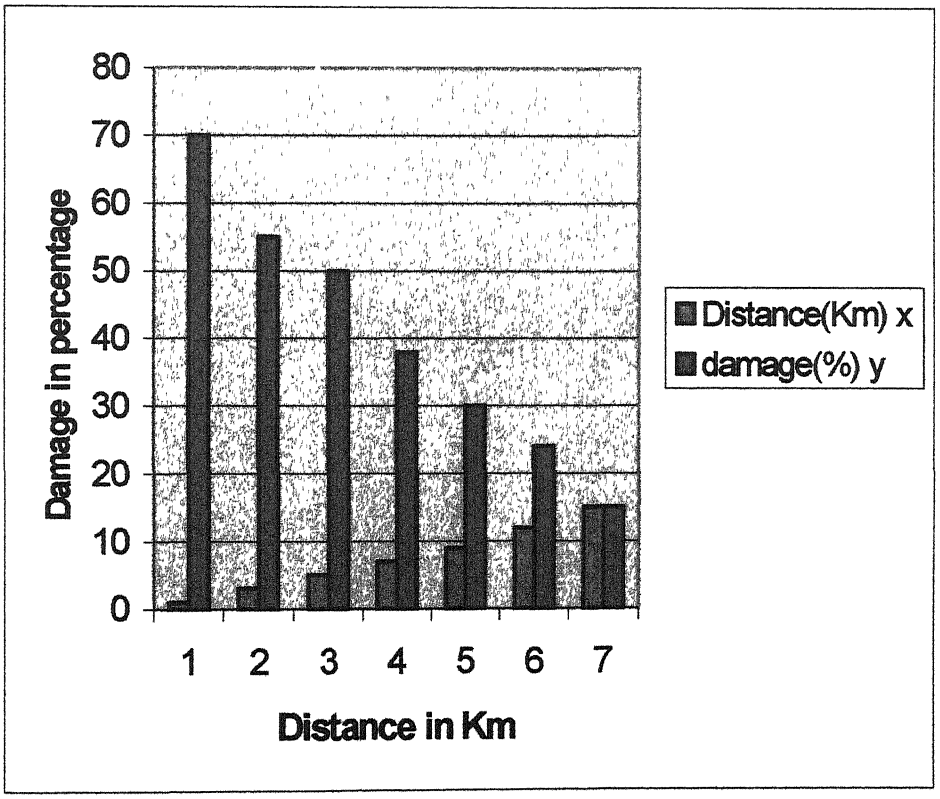


Table 4 showing land ownership pattern of the sampled population.

**Table 4.**

| SN | Land ownership (bigha) | No of farmers (f ) | Mid Value (x) | Fx | $fx^2$ |
|---|---|---|---|---|---|
| 1 | 0-1 | 43 | 0.5 | 21.5 | 10.75 |
| 2 | 1-2 | 27 | 1.5 | 40.5 | 60.75 |
| 3 | 2-3 | 13 | 2.5 | 32.5 | 81.25 |
| 4 | 3-5 | 12 | 3.5 | 42 | 147.00 |
| 5 | 5-8 | 5 | 6.5 | 32.5 | 211.25 |
| | **Total:** | 100 | | | 511 |

***NB.*** 1.5 bigha = 1 hectare

1 acre = 0.405 hectare

From ***table 4***, the average land ownership per family is **2.25** bigha and the CV is **74.98%.** This indicates low land ownership of the majority & the variation is very high.

The land ownership pattern in the buffer zone is shown in a ***bar graph.***

**Fig.**

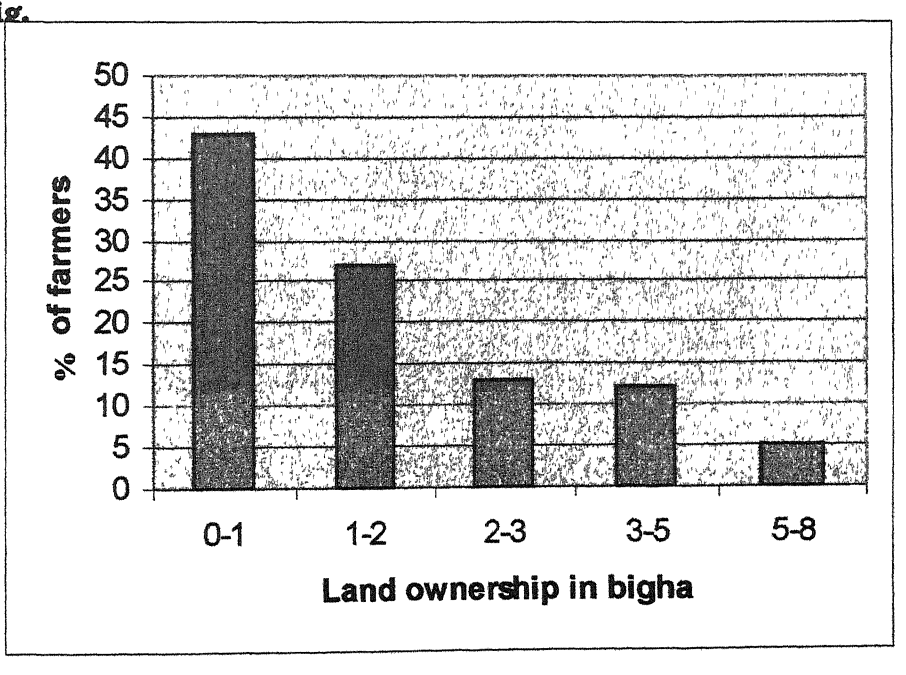


***Table 5*** shows the computation table of the damage by various animals.

**Table 5.**

| Name of animal | $O_i$ | $E_i=\Sigma O_i/n$ | $O_i-E_i$ | $(O_i-E_i)^2$ | $(O_i-E_i)^2/E_i$ |
|---|---|---|---|---|---|
| Wild buffalo | 45 | 25 | 20 | 400 | 16 |
| Boar | 20 | 25 | -5 | 25 | 1 |
| Deer | 17 | 25 | -8 | 64 | 2.56 |
| Birds | 18 | 25 | -7 | 49 | 1.96 |
| | | | | $\mathbf{x^2}$ = | 21.52 |

$H_0$: the damage by the wild animals is same

$H_1$: the damage by the wild animals is not same

Under null hypothesis, the test statistic is

$$x^2 = \frac{\Sigma(O_i - E_i)^2}{E_i}$$

Where $E_i = \frac{\Sigma O_i}{n} = \frac{100}{4} = 25$

$\therefore x^2 = \mathbf{21.52}$

Which is highly significant with $x^2_{0\ 01,3} = \mathbf{11.34}$

Hence the null hypothesis is rejected and it shows that the damage vary with the type of wild animal i.e. the water buffalo makes maximum damage as compared to other animals.

***Table 6***. shows the benefit or harm as perceived by the respondents with respect to the establishment of the wild life reserve.

**Table 6.**

| | Before established of wild life Reserve | After wild life | Total No. of Forms |
|---|---|---|---|
| Benefited | 26 | 7 | 33 |
| Harmed | 8 | 59 | 67 |
| **Total:** | 34 | 66 | 100 |

The following computation table is used for analysis.

| **Cell** | $O_i$ | $E_i$ | $O_i-E_i$ | $(O_i-E_i)^2$ | $(O_i-E_i)^2/E_i$ |
|---|---|---|---|---|---|
| (1,1) | 26 | 11.22 | 14.78 | 218.4484 | 19.469554 |
| (1,2) | 7 | 21.78 | -14.78 | 218.4484 | 10.02977 |
| (2,1) | 8 | 22.78 | -14.78 | 218.4484 | 9.589482 |
| (2,2) | 59 | 44.22 | 14.78 | 218.4484 | 4.9400362 |
| | | | | $x^2 =$ | 44.028843 |

Null Hypothesis: The wild life does not affect the farmer

Alternative hypothesis: The wild life affects the farmers

Under $H_0$: $x^2 =$ **44.03**

Which is highly significant with $x^2_{0\ 005\ ,\ 1} =$ **3.84**

Hence the null hypothesis is rejected and it is concluded that the wild life affects the life of individuals in surrounding area.

***Table 7a***, computation table shows the mean damage of different crops with respect to their distances from the reserve.

**Table 7a.**

| Distance in Km | Damage % of crops | | | | | Mid Value (x) | $F_px$ | $F_wx$ | $F_mx$ | $F_{mi}x$ | $F_ox$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $F_{paddy}$ | $F_{wheat}$ | $F_{maize}$ | $F_{millet}$ | $F_{others}$ | | | | | | |
| 0-5 | 38 | 40 | 12 | 3 | 7 | 2.5 | 95.0 | 100 | 30.0 | 7.5 | 17.5 |
| 5-10 | 26 | 12 | 10 | 5 | 2 | 7.5 | 195.0 | 90 | 75.0 | 37.5 | 15.0 |
| 10-15 | 17 | 20 | 16 | 2 | 15 | 12.5 | 212.5 | 250 | 200.0 | 25.0 | 187.5 |
| 15-20 | 9 | 12 | 6 | 8 | 4 | 17.5 | 157.5 | 210 | 105.0 | 140.0 | 70.0 |
| 20-25 | 10 | 6 | 3 | 1 | 8 | 22.5 | 225.0 | 135 | 67.5 | 22.5 | 180.0 |
| **Total:** | 100 | 90 | 47 | 19 | 36 | | 885.0 | 785 | 477.5 | 232.5 | 470.0 |

***Table 7b***, computation table shows the variation of damage under different crops.

**Table 7b.**

| | | Variance | | | | |
|---|---|---|---|---|---|---|
| **Distance in Km** | **Mid value x** | $F_px^2$ | $F_wx^2$ | $F_mx^2$ | $F_{mi}x^2$ | $F_ox^2$ |
| 0-5 | 2.5 | 237.5 | 250 | 75 | 18.75 | 43.75 |
| 5-10 | 7.5 | 1462.5 | 675 | 562.5 | 281.25 | 112.5 |
| 10-15 | 12.5 | 2656.3 | 3125 | 2500 | 312.5 | 2343.8 |
| 15-20 | 17.5 | 2756.3 | 3675 | 1837.5 | 2450 | 1225 |
| 20-25 | 22.5 | 5062.5 | 3037.5 | 1518.8 | 506.25 | 4050 |
| **Total:** | | 12175 | 10763 | 6493.8 | 3568.8 | 7775 |

Mean damage= $\frac{\sum Fx}{N}$

Mean damage of paddy = $\frac{\sum Fx}{N}$ = 885 / 100 = **8.85 quintals**

Mean damage of wheat = $\frac{\sum F_w x}{N}$ = 785 / 90 = **8.72 quintals**

Mean damage maize = $\frac{\sum F_m x}{N}$ = 477.5 / 47 = **10.16 quintals**

Mean damage millet = $\frac{\sum F_{mi} x}{N}$ = 232.5 / 19 = **12.23 quintals**

Mean damage other crops = $\frac{\sum F_0 x}{N}$ = 470 / 36 = **13.05 quintals**

Standard Deviation = $\left[\frac{\sum fx^2}{N} - \frac{\sum fx^2}{N}\right]^{½}$

S.d. of paddy = $\left[\frac{\sum f_p x^2}{N} - \frac{\sum f_p x^2}{N}\right]^{½} = \left[\frac{12175}{100} - (885/100)^2\right]^{½}$ = **6.59**

S.d. of wheat = $\left[\frac{\sum f_w x^2}{N} - \frac{(\sum f_w x)^2}{N}\right]^{½} = \left[\frac{107625.5}{90} - (785/90)^2\right]^{½}$ = **6.6**

S.d. of maize = $\left[\frac{\sum f_m x^2}{N} - \frac{(\sum f_m x)^2}{N}\right]^{½} = \left[\frac{6493.25}{47} - (477.5/47)^2\right]^{½}$ = **5.91**

S.d. of millet = $\left[\frac{\sum f_{mi} x^2}{N} - \frac{(\sum f_{mi} x)^2}{N}\right]^{½} = \left[\frac{3568.75}{19} - (232.5/19)^2\right]^{½}$ = **6.17**

S.d. of other crops = $\left[\frac{\sum f_o x^2}{N} - \frac{(\sum f_o x)^2}{36}\right]^{½} = \left[\frac{7775}{36} - (470/36)^2\right]^{½}$ = **6.74**

C.V. = (s.d. / mean) × 100

C.V. of paddy = (6.59 / 8.85) × 100 = **74.46%**

C.V. of wheat = (6.6 / 8.72) × 100 = **75.68%**

sC.V. of maize = (5.91 / 10.16) × 100 = **58.16%**

C.V. of millet = (6.17 / 12.23) × 100 = **50.45%**

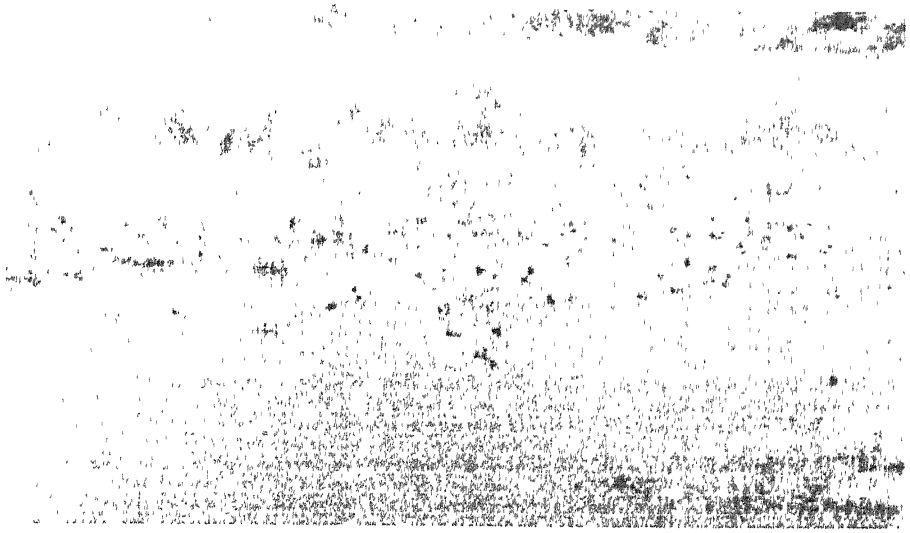
C.V. of other crops = (6.74 / 13.05) × 100 = **51.64%**

From above tables it is clear that the highest and the least damage of crop correspond to cash crop ***(13.05 quintals)*** and wheat ***(8.72 quintals)***. Similarly the maximum and minimum coefficient of variation corresponds to wheat ***(75.68 %*** and ***millet 50.45%)***. This indicates that the damage of wheat is more heterogeneous than other crops and damage in millet is uniform.

Observation on land distribution for ***paddy, wheat, maize,*** and cash crops in different district, shows the simultaneous farming in the buffer zone. Hence, wildlife depredation also somehow minimizes by their scattering all around the buffer zone. The main wildlife of Koshi Tappu is wild water buffalo (*Bubalus bubalis*) which mainly damage the newly growing crops, like ***paddy, wheat, sugarcane***, varieties of pulses, ***maize*** and ***other cash crops***. But in the observation one very important things had been observed that the plants of ***Sunflower*** *(Helianthus annus)* which is disliked by the wild water buffaloes (*Bubalus bubalis*) and the ratio of depredation by wild life was also minimum in sunflower farming of buffer zone.

## FREQUENT FIELD OBSERVATION:

Under frequent field observation , the various types of observation were collected viz crop damage, drifting of the logs, migratory birds on cropland ***(mainly during September and October)***, wild life on cropland mostly in rainy season, army patrolling inside the reserve for the protection of wild life, several programmes conducted by NGO and INGO for the people of buffer zone, etc. In the



Migratory and residential birds in the reserve show the significance of Ramsar site.

*13 Jan 2001 (Photo: Hari Thapaliya)*

Common water fowl of KTWR

*12 Sep. 2000 (Photo: Hari Thapaliya)*

mean time, the wetland were full of organic nutrients resulting in eutrophication. Few tourist have been observed during the field observation. They were enjoying the birds of wetlands.

In the frequent field observation, it was observed that the maximum damaging crop was paddy, because it remains in the field for the maximum time followed by sugar cane which was badly damaged by the attack of wild animals from the reserve viz Arna, jackal, and wild boar. Birds were also damage various crops at various stages of their life mostly paddy and wheat during the early stage of crops. The least damaged crops which was observed in ***Sunflower*** (*Helianthus annus*) but its acrage is low and less liked by wild animals.

Peak damage by wildlife was observed between mid July to mid November of every year. The residents of buffer zone were used huts and fire to protect their crops against wildlife. There was less damage was done to the crops by the wild life between March and June. A certain amount of damage is done throughout the year. A big damage was noted during the grass-cutting period as the wild animals tend to come out in the buffer zone.

The field observation have shown that the people of eastern region were less educated and less wealthy than the western region. The minimum range of conflict were observed in western region, and least effected by wild water buffaloes. Therefore a great variation of economy can be observed amongst the residents of buffer zone of east

**Sugarcane farming in buffer zone**

*2 July 1999 (Photo: Hari Thapaliya)*

**Sunflower framing in buffer zone**

*Aug 4, 2000 (Photo: Hari Thapaliya)*

and west zones of KTWR. Accordingly, fencing the boundary of Reserve were observed only in easter region. The army movement in the park was frequently observed in both eastern and western region. But the head office of army and wild life ***(Warden's office)*** for KTWR both situated in eastern region at ***Kushaha*** due to which maximum patrolling observed in eastern region than the western region.

During the time of field observation, ***numerous birds, mammals, reptiles, amphibians, fishes*** and ***other invertebrates*** were observed inside the Reserve. The main protected animals *Bubalus bubalis* were mostly observed in the cropland of buffer zone daily during the evening time from ***July to September***. The number of B*ubalus bubalis* were less on the cropland during ***October to December***. ***Eight to ten*** *Bubalus bubalis* on one herds were seen ravaging the crop at night in the buffer zone during ***March and April***. During ***May and June***, they were seen in the fields on day and night. Wild boar was rarely seen in the crop land during those times. Few species of birds and other wild mammals were also observed very rarely on the cropland.

## MONITORING LIVESTOCK GRAZING :

Regarding monitoring of the livestock grazing, there were the tame animals which supported the enhancement of economical condition of buffer zone. About, ***22%*** people of the buffer zone had less than ***5*** domestic animals. Likewise ***38%*** of residents possessed **5** to **10** animals, **10 to 15 %** of residents had more than **15** domestic animals were noted from the field observation. The domestic animals

Cattle grazing outside the boundary of reserve

*Sep 12,2000 (Photo: Hari Thapaliya)*

Fish pond in buffer zone

*Sep. 12, 2000 (Photo: Hari Thapaliya)*

were include ***cows, buffaloes, goats, ducks, chickens, pigs***, etc. Most of the domestic animals were harassed by the wildlife. Domestic animals generally enter inside the Reserve for their feeding which causes a deficiency of food for the wild life inside and forcing them to come outside. It was found that about ***1000 to 15000*** domestic buffaloes were still inside the reserves, most of them were observed from ***Saptari*** and few from ***Sunsari*** district. Other livestock like ***cow, ox, calf,*** etc were also monitored and found grazing inside the reserve in large numbers.

The highest number of domestic animals were observed in ***Saptari*** district and the lowest in ***Udayapur*** district in the time of monitoring the livestock grazing.

During the time of livestock monitoring; poverty in buffer zone, illiteracy, malnutrition, insufficient number of health post and transportation on the buffer zone were observed. While damaging of fencing, incoming and outgoing of livestock and wild life respectively have also been observed. In the meant time wild buffalo attack human and its damages to the cropland, livestock grazing site, army patrolling and torturing to the local residents, vehicle allowing inside, and flooding in Koshi during ***July to September*** on each year were also observed during the monitoring of the livestock grazing in the Reserve.

## THATCH GRASS (*Imperata cylindrica*) CUTTING SURVEY :

Grass cutting is done in case of perennial varieties of grasses like *Imperata cylindrica*. It is greatly used in the preparation of

Grass cutting in the reserve

*14 Jan 2000 (Photo: Harı Thapalıya)*

Fire wood collection in the reserve

*14 Jan 2000 (Photo: Hari Thapalıya)*

thatches to protect the houses from sun and rain. These are not meant for feeding the cattle. In this regard, first of all the grass cutters were provided with questions for interview in each entry point of the reserve. There were 8 official entry points; four from ***Sunsari***, three from ***Saptari*** and one from ***Udayapur*** district. But there were use many non-official entry points due to the open boundary. This sample is based on the assumption of ***Sharma, 1991***.

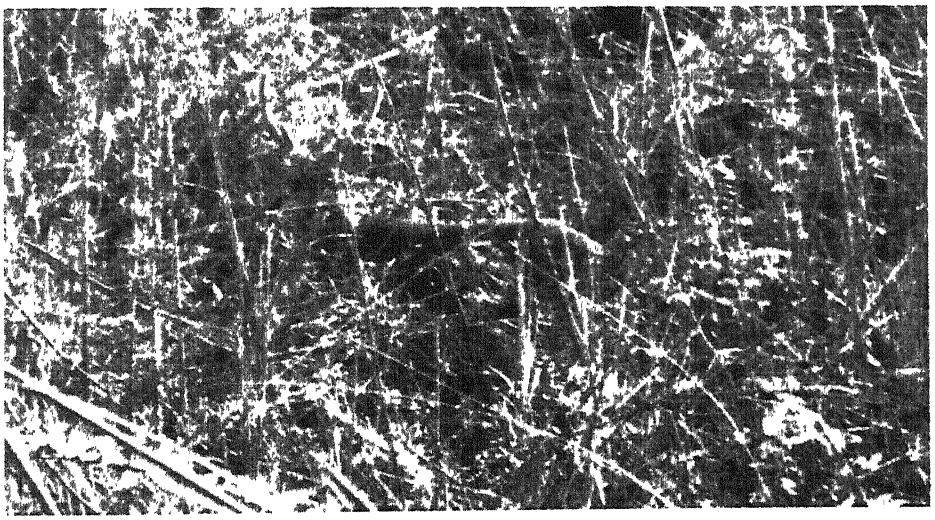
In the survey, more than ***84% of grass cutters*** were live in the adjoining villages ***(within 5 Km of reserve), 13%*** of residents have been observed in the village unit next to adjacent village units roughly between ***5 to 10 Km***. The next unit after ***10 Km*** of the Reserve, i.e. about 2% grass cutters were noted. This observation have shown the maximum benefited groups of grass cutting period were adjacent villagers within the ***5-km*** boundary of the Reserve.

The most useful grass of KTWR is thatched grass (*Imperata cylindrica*), which is generally sold and used for roofing of houses. Cost of the grass varies according to the time periods, ranging from almost ***1500 NRs to 2100 NRs per 100 kg***. Its cost is low during the grass-cutting season from Dec. to Feb. but the price raises between April and June. Other important grasses reported are *Vetiveria wizanouds*, *Phragmtes karka*, *Sacharum spontaneum*, and *Typha angustifalia* which were also cut after the completion of *Imperata cylindrica*.

At the time of grass cutting survey, it was found that there were

A Python in the marshy land of reserve area

*17 Jan 2001 (Photo: Hari Thapaliya)*



A dear in the natural habitat of wild water buffalo

*17 Jan 2001 (Photo: Hari Thapaliya)*

big competition among the grass cutters for *Imperata cylindrica* (called ***"Khar" in Nepali)*** for the first few days. As the amount of *Imperata cylindrica* finishes, then the grass cutters were cut other grass varieties. Actually about ***4%*** respondents said, that they could not get enough thatches due to the permission for short grass-cutting period. There is no proper estimation of total grasses, although ***1,23000 NRs*** per annum for 1999 have been raised by coupon distribution to ***24600*** individuals.

In the interview, respondents were asked about their major complaints against the management of grass cutting. The table below shows that less than ***10%*** of the respondents were satisfied with the management.

The observation on grass cutting also gave the view about the number of wild water buffalo (***Arna***). About ***52%*** of grass cutters from 3 districts said the number or ***Arna*** is increasing while ***48%*** of them have reversed views and said the number is slowly decreasing because of flooding, poaching and hunting during crop depredation and through some transferable disease. But ***52%*** of grass cutters were totally ignored such views and stressed the views on increase in their number.

Aboout 88% of the grass cutters were in favour of cross sex with the wild water buffalo. They said that domestic buffalo crossed with the *Bubalus bubalis* were produce hybrids from which they could get better value. 12% of the grass cutters were against crossbreeding

A male wild water buffalo in natural habitat surrounding by *Imperata cylindrica*

*17 Jan 2001 (Photo: Hari Thapaliya)*

Herds of wild water buffalo *(Bubalus bubalis)*

*Photo: Resource Profile)*

between domestic buffalo and *Bubalus bubalis*. They said that the cross sex with the *Bubalus bubalis* is bad because the gene purity of wild water buffalo will suffer.

***Table 8*** showing major complaints for grass cutting.

**Table 8.**

| Major Complaint from respondent | Percent respondent |
|---|---|
| Fire wood should be officially allowed during cutting period | 79.2% |
| It won't be allowed | 20.8% |
| Current Practice is o.k. | 9.8% |
| Current Practice should be improved | 90.2% |
| Grass cutting day should be added in summer | 88% |
| It should be as it is | 12% |
| Grass cutting duration should be extended for more than 15 days | 92% |
| It should be as it is | 8% |
| Small wood for agriculture and building construction should be permitted | 76% |
| It should not be permitted | 24% |

About ***16%*** of grass cutters said the relation with the reserve is good while the huge percentage (about ***55%***) had counter view and said the relation with the reserve is bad. The third group of grass cutters (about ***29%***) had an opinion that, they felt the relation is neither good nor bad, it is just normal.

The ***55% grass cutters*** had negative attitude towards the reserve because of depredation by wildlife, strict prohibition to enter the livestock inside and un-availability of compensations from the reserves. Sixteen percent had positive views towards the reserve. They felt that they at least could collect logs and grasses. They were not suffered as previous days from the flood because it is controlled to some extent for the sake of reserve. ***29%*** grass cutters had no more close attachment with the reserve. Until or unless they get more advantage from the reserve, their approach won't be change.

## PRA OBSERVATION :

On the basis of PRA report regarding the reform and no reform after the establishment of the Reserve. Out of ***100, 70 % PRA*** were of the viewed that there is some reform but ***30% PRA*** ignored the view and said that there is no reform and change in the general life of the people. There was a group of PRA totally unconcerned with reform and no reform activities in general. The views given by the some PRA was that there is some hope for a reform but the majority of the PRA ***(90%)*** were of the view that wild life reserve is not going to improve or reform in the life style of people. Thirty percent of the PRA had shown no

interest about the Reserve activities either it could be good or not.

Mainly the PRA was carried out for the fluctuation of Arna (*Bubalus bubalis*) population, of which ***80%*** of PRA said that the population of *Bubalus bubalis* are fluctuating due to the sedimentation and shifting of the course of the river and it should be controlled properly. Ten percent of the PRA said that it is normal and ***10%*** of the people had no idea on this problem. As such, ***70%*** PRA were unhappy with the slow increasing number of these endangered species, ***20%*** were happy and they did not want ***Arna*** (*Bubalus bubalis*) in KTWR because it damages their crops and 1***0%*** had no comment on these aspects.

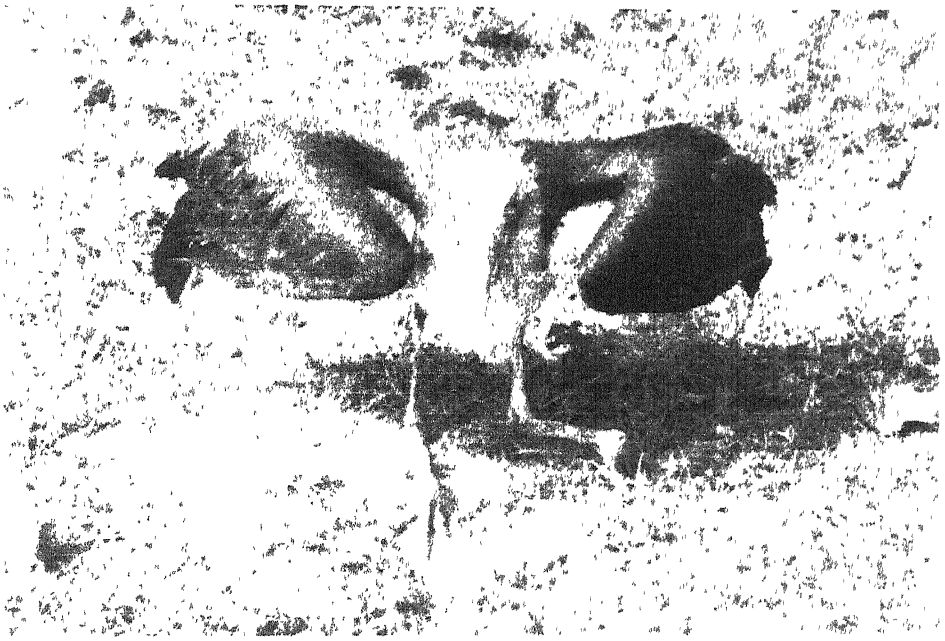
The PRA were indicates that the most of the literate people were used cross-breeding between their domestic buffalo with *Bubalus bubalis*, so that the improved hybrid can be sold for higher price in India.

The ***75%*** PRA gave the solution for increasing the number of Arnas viz the loss of vegetation and habitat degradation inside the reserve should be prevented. Even the few species of plants were locally extinct. Twenty percent of PRA have not shown their view on this concern. Ninety percent of PRA had the opinions on protection of *Bubalus bubalis* were done by using the regular monitoring and flood controlling and ***10%*** PRA have not shown their opinion on this concern. About ***60%*** of PRA were gave the reason of decreasing the

number of ***Arna*** is due to entry the herds of domestic buffalo inside the reserve because they could affect its gene purity while 40% were solely negative in such approach.

The main cause of decreasing *Bubalus bubalis* population is due to the ***poaching, hunting, disturbances*** (*men* and *vehicles*), and ***disease*** which were said by ***70%*** of PRA. Thirty percent of PRA were unknown of these. Eighty five percent of PRA had thought that it is best to translocate these endangered species to other suitable places for its better protection, while ***15%*** were not shown their opinion on it.

The checklist of bio-diversity from natural resources ***management unit, warden's office, local people, book of taxonomy, reports of IUCN, DNPWC, PPP*** have been used for studying the bio-diversity of Reserve. From all these resources, it was clear that KTWR possess **514** species belonging to **99** families of plants, **31** species of mammals with **18** families, **461** species of birds with **69** families, **46** species of amphibians and reptiles with 16 families, **117** species of fishes with **24** families and **77** species of butterfly with **8** families (***Appendix, 4,5,6,7,8,9***). Most of them have been observed during the time of field observation.



A endanger bird species

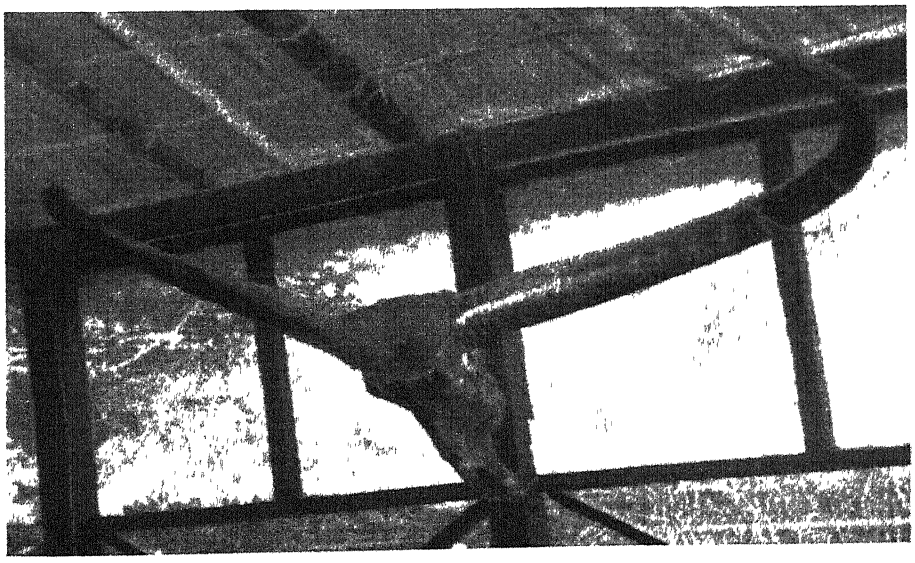
*5 Oct, 1999 (Photo: Hari Thapaliya)*

Water birds picking food in the reserve

*17 Jan 2001 (Photo: Hari Thapaliya)*

**Few male horns of wild water buffalo**

***April 29, 2000 (Photo: Hari Thapaliya)***



**A female horn of wild water buffalo**

***April 21, 2000 (Photo: Hari Thapaliya)***

# RESULT
# DND
# DISCUSSION

# Chapter-5 RESULT AND DISCUSSION

In the present study various factors were taken to find out the causes responsible for deteriorating socio-economic condition of the people around KTWR.

## POPULATION :

The causes of fluctuation in population in all the **12 VDCs** of ***3 districts*** studied are mainly due to immigration of people from hill area after the establishment of wildlife reserve. It was found that maximum population increase and encroachment have been shown in ***Tapeshwori*** and ***Prakashpur*** VDC respectively. It is because of immigration of people from the adjacent hill area due to deteriorating resources for their livelihood may be one of the major causes of increase in population. The decreasing population in ***Pipra*** seems to be due to certain forest reserve restrictions which has deprived extraction of resources from the reserve leading to migration of families from the VDC. Higher the number of female were observed in villages near the reserve, which was probably due to need for collection of fuel resources. The household number decrease in such VDCs of which were near to the reserve that may be due to the flood and maximum wild life depredation.

***Sah (1997)*** also supported this view. As such, similar observations were made in KTWR. Immigration of the people from other side in buffer zone is mainly for fishing in the wetlands and also for grass cutting inside the reserve. It is also due to the low price value of land. This finding supports the rate of population variation in each VDC of the buffer zone.

Increase of population in various VDCs is a natural

phenomenon but the rate of increment is less in most of the VDCs. This is due to the reserve and its wild life which damage the crops and attack livestock. Emigration of the residents was also frequently noted in the time of study. Major emigrants are from the lower classes to search for better employment opportunities, whereas minor emigrants are from higher classes due to wild life depredation from the reserves. All these factors responsible for variation in population of buffer zone was also supported by the findings by of ***Upreti (1985)*** in RCNP, ***Sharma (1991) Mishra (1981)*** in RCNP, and ***Sah (1997)*** in KTWR.

The human population denotation was recorded by ***Anan (1987)*** in buffer zone is about ***270 per Km*** in the eastern and ***278 people per km*** along western boundaries which is increasing slowly and now it is more than this ratio. Due to increasing such population densities, more problems could be raised for management of the reserve in the commencing days.

The socio-economic analysis of cost and benefits of local residents of KTWR showed poor attitudes towards ethnicity and the literacy rate of people. Conservation education program is critically needed ***(Mishra 1984).*** All parks and reserves have conflict with their neighborhood ***(Heinen*** and ***Kattel, 1992)*** but they are acute in Koshi Tappu for several reasons. It is because the reserve is too small and population pressure is very high, it cannot provide adequate food year around. The species impose direct cost to the people by crop destruction and the region is densely populated ***(Heinen 1992)***. The study is very similar with present findings.

## CROP DAMAGE :

Observation on the damage shows that the wild buffalo, wild boar and porcupines damage crops in the agriculture land near forest.

Due to the presence of large numbers of livestock, wild animals have to compete with them for shelter. This is probably the reason that wild buffaloes come out of the reserve and graze in the crop field. The migratory bird comes to the KTWR during September and October, which is the rice ripening period, and damage rice. Jackals and wolves enter the villages and destroy poultry and goats. **Sah (1997)** reported in his study, that out of total crop damaged, paddy came to be first, then sugarcane, wheat, potato, maize, pulses and jute in 3 VDCs of eastern **Sunsari.**

The field survey showed that the damage was about **25%** in 1999. It recovered **32-60%** damages of paddy and maize in 1994-95 ***(Warden's office)***. It was found that about **40** to **65%** of crop was damaged in 2000 and 2001 by wildlife ***(warden office)***. This was fairly higher than the damage recorded in other National parks. The study in KTWR showed that the percentage of the damage increased in the year when the flood was severe.

In rainy season, Koshi river floods cause more damage to the crops and livestock. Herbivores come out from the reserve and damage the crops, while carnivores victimize poultry and goats.

***Upreti (1985)*** and ***Shrestha (1994)*** identified the rhino as a principal crop raider in ***Royal Chitwan National Park. Sharma (1991)*** found wild elephant, wild boar and chital to be the main raiders of Royal ***Shuklaphat*** Wildlife Reserve. ***DNPWC (1998)*** reported wild boar as a principal crop raider in ***Shivapuri*** Watershed and Wildlife Reserve. Similarly, ***Shah (1997)*** had reported that the wild water buffaloes and wild boars are the main crop raiders in KTWR. ***Kharel (1993)***, ***Nepal*** and ***Weber (1993)*** reported that the crop damage of different national parks was due to the wild boar,

which was the important crop raider in the neighborhood. But in KTWR, wild buffalo was found to be the main crop raider and it damaged almost all crops except ***Sunflower*** (*Helianthus annus*), while wild boar has done the least damage to crops amongst other wildlife of the Reserve.

Crops like ***paddy, wheat, millet, potato, pulses, sugarcane*** and ***jute*** are found to be damaged by wild water buffalo. However, the ***Sunflower*** (*Helianthus annus*) plants are completely ignored by the wildlife so that ***Sunflower*** (*Helianthus annus*) farming around KTWR is the safest and should be encouraged to the people around the reserve. The animals of the reserve area destroy the crops of the respondents having land in buffer zone. Those who did not have their own lands expressed positive attitude towards the establishment of the wildlife reserve as they get fishes and also thatch grass from the reserve. ***(Menon, 1962)***. In this finding, no discrimination has been shown by the people about the reserve whether they have their own land or not. Most of the residents have negative vision about the forest reserve but if they are provided with some incentives through the reserve, it could be possible to minimize it. Damage by the various wild animal have also been reported in ***WMI\IUCN, 1994.***

The main cause of damage is lack of any effective physical barrier between the border of buffer zone and reserve. Flood in the Koshi River, minimum amount of fodder grasses inside resulting in food scarcity, sheltering problem and the Koshi River itself are the various reasons for disenchantments amongst the local people.

## WILD WATER BUFFALO *(Bubalus bubalis)*

The main threat to the wildlife is its habitat destruction or

reduction of the food resources. The main protected species of the KTWR is ***wild water buffalo*** (*Bubalus bubalis*), though its number has increased slowly and its pure breeds are being mixed with the domestic buffalo (PPP, 1999).

The reserve is mainly established for the conservation of wild water buffalo and to highlight the need of restoration program for wild water buffaloes in Nepal ***Sah (1997). Mishra (1981)*** has previously recommended this, but funds have not been made available by the government as yet. ***Royal Chitwan National Park*** offers the best site for reintroduction. It has been declared a ***"World Heritage Natural Site" (Thorsell, 1985)*** and is relatively well-managed national park. ***Chitwan*** has extensive riverine habitat along its northern border and abundant upland habitat. Forest offers a refugee for buffalo during the rainy season and it can be used to reduce flood and the mortality of calves ***(Heinen 1992)***, but this is impracticable because translocation of wild water buffalo from their natural habitat to RCNP is least preferred. The extension or elaboration of KTWR and afforestation to the habitat in KTWR will improve the condition.

The number of wild water buffaloes varies year to year. It was ***100*** in ***1945 (Warden office)***, ***63*** in ***1976 (Dahmer, 1978)***, ***91*** in ***1987 (Heinen, 1993a)***, ***93*** in ***1998 (Heinen, 1993a)*** ***158*** in ***1993 (Suwal, 1993)*** and ***145*** in ***2001(Heinen, 2001)***. This fluctuation in number of ***Arna*** (Napali Name for the *Bubalus bubalis*) year to year is due to poaching, poisoning and flooding. The other reason being that the local livestock herd holders who continue to practice livestock growing within the reserve and exercise their traditional right to use the wetland resources of Koshi Tappu. Illegal human activities inside the reserve and unavailability of natural supply of food for the wild

water buffalo are becoming a threat to their sustainability. Hence the ***Arna*** (*Bubalus bubalis*) has no alternative except feed on the agricultural land of buffer zone especially in peak grass growing months. Moreover, the cutting of jungle plants and grasses of the reserve add to their miseries towards food supply.

A sizeable number of people's opinion was translocation of wild water buffalo to other habitat, which is solely illogical. The wild water buffaloes population is still not increasing satisfactorily in their own habitat. If they are transported to other habitat, it will be an experimental exercise in which might show encouraging result, but it cannot be assured for certainty, and it won't be economical. The result couldn't assure whether the sustainability of these endangered species would be higher or lesser. The increasing rate in number of endangered species could be satisfactory by frequent observation and monitoring by the wildlife staffs regularly. The results, which come from the PRA, have also given the solution of highlighting the need of restoration program for this endangered species (*Bubalus bubalis*) in Nepal.

Cross breeding between domestic and wild water buffalo gives hybrid and the impact is always threatened to the integrity of the gene. ***Heinen (1993 b)*** believes that this is not a severe threat because males of domestic buffalo are observed very infrequently on the reserve. Hence, ***Heinen*** assures that it is unlikely that a domestic male could monopolize a wild mixed herd in competition with the wild males. The progeny production is of a mixed breed.

Flooding is the main problem for the protection of wild water buffaloes, while the calf (***young Arna***) cannot be protected from the big flooding. Sufficient grassland should be required for the grazing

inside and scientific methods of controlling the flood may help to increase the number of ***Arna*** in the fast rate. The reserve should have proper fencing around so that people can't enter inside and wild buffaloes also can't come outside in the buffer zone. Proper fencing will help in restricting the reciprocal in and out from the reserve.

## BIODIVERSITY :

Besides the ***Arna***, KTWR is extremely important for the conservation of other bio-diversity as such the staging and especially wintering habitat for migrating water fowl ***(Inskipp and Inskipp, 1985 ; Heinen, 1988)***. The reserve is also important for increasing the local economy especially to provide ***thatch grass*** (*Imperata cylindrica*) and fishing right to local residents .For this reasons, KTWR should remain a protected area and remain the best area of wild water buffalo. It is possible to DNPWC for wildlife conservation in connection with the ***Department of Forestry***. To create flood refuge for wild water buffalo and other large mammals, district forest areas can be used which is located within ***3 km*** of the north eastern and ***5 kms*** of northwestern boundary of KTWR. The co-operation between all concerned agencies are critically needed to maintain much large mammal population because individual management units are generally small ***(Heinen, 1992)***.

Now, the other endangered species of KTWR are ***Chittal*** (*Axis axis*), ***Nilgai*** (*Boselaphus tragocamelus*) and ***Gangetic dolphin*** (*Platinista gangatica*) which were very common in past but now they are rarely seen. The carnivorous like ***Jungle cat*** (*Pelis chaus*), ***Tody cat*** (*Paradoxesus hermaphroditus*) and ***Fox*** (*Vulpes bengalensis*), ***Jackal*** (*Canis allreus*) etc are common. Like wise the Ungulates of KTWR includes ***Hogdeer*** (*Axis porcimus*), ***Spotted deer*** (*Axis axis*),

***Barking deer*** (*Muntiacus muntjak*) , ***wild boar*** (*Sus serofa*) etc are also common. But the number of such animals are not increased satisfactorily.

The reserve was also established for the improvement of the birds, mainly the migratory waterfowl. ***Swamp Francolin*** (*Francolinus gularis*), a globally threatened species was commonly observed in the park during its breeding season. Other species which come in the park for breeding were ***Black Francolin*** (*Francolinus francolinus*), ***Lesser whistling duck*** (*Dendrocygna javanica*), ***Fulvous-breasted woodpecker*** (*Dendrocopos macei*) etc. The common winter visitors are ***Ruddy shelduck*** (*Tadorna ferruginea*), ***Gadwal*** (*Anas strepera*), ***Mallard*** (*Anas platyrhynchos*) etc. ***Spot-billed duck*** (*Anas poecilorhyncha*) were commonly observed as residential and winter visitors in the park. Besides these, passage migrants like ***Northern Pintail*** (*Anas acuta*), ***Common teal*** (*Anas creca*), ***Garaganey*** (*Anas querquedula*) and ***Common hoopoe*** or ***Wood-pecker*** (*Upupa epops*) were observed in summer as well as in winter and are the passage migrant. ***Blue-tailed bee-eater*** (*Merops philippinus*) and ***Indian Cuckoo*** (*Cuculus micropterus*) were common birds observed in summer and they came to wetland for the purpose of breeding. The important migratory birds staying in winter were reported as: ***50,000 Pintail*** (*Anas acuta*), ***7000 Whistling teal*** (*Dendorcygna javanica*), ***4000 Ruddy shelduck*** (*Todoma ferruginea*), ***2000 Common teal*** (*Anas crecca*) and ***1800 Gragancy*** (*Anas querquedula*) ***(Scott 1989)***. Now a days few species of birds are endangered, some are susceptible and very few are vulnerable.

Among the other vertebrates the ***Python*** (*Python molurus*), ***Gharial*** (*Gavialis gangeticus*) and ***Crocodile*** (*Crocodylus palustrues*)

were commonly seen inside the reserve and wetlands respectively. Most of snake species like ***Checkered Keelback*** (*Xeochrophis piscator*), ***King Cobra*** (*Opliophagus hannah*) etc were also reported but their numbers were diminishing by using fire and flooding. Due to this reason ***Lizards*** and ***Amphibian*** are searching the more protected areas for their survival. Among the herpetofauna of KTWR, **17** species are nationally threatened where the **6** species are globally ***Sah*(1997)**. The most common species of fish in KTWR are ***Sidhra*** (*Puntius ticto*), ***Pothi*** (*Barilive barna*) and ***Puntius conchonues*** which were observed commonly. The new record to Koshi River is ***Bhitta*** (*Damic rerio*), from ***Kamalpur Daha*** and also a new record for Nepal ***(BPP 1995)***. The ***117*** species of fishes in KTWR have been reported where **91** species are resident, **21** species are local migratory and **5** species migratory. The **9** species threatened for survival, of which **8** species are vulnerable and 1 species is endangered ***(BPP, 1995*** and ***Sah 1997).***

During the field visits the butterfly viz; are ***Indian crow*** (*Euploca core*), and ***Common tiger*** (*Danais chryssipus*), were frequently observed from October to January. The increasing number of ***Butterfly*** also not satisfied may be through the several disturbances.

In the heavy monsoon, the barrage gates of Koshi are closed to regulate the floodwater, which consequently causes drowning of wildlife inside the reserve. Some escapers are killed in adjoining field. This is the fact that bio-diversity is threatened by several problems due to which most of the vegetation viz; ***Acasia catechu, Dalbergia sissoo, Saccharum typha, Cymbopogon saccharum*** etc. were decreasing in quantity and few are being extinct in KTWR. As such few wildlife are also being endangered and their increasing number is

also not constant. Unscientific collection of logs, plants and grasses are also the causes of declination of flora in the Reserve. On the same ratio the fauna also become endangered and causes ecological ımbalance in the Reserve. (Detail of Biodiversity have mentioning to appendix 4-9).

## PARK PEOPLE CONFLICT :

After the establishment of any national park or conservation area, there should be close interaction with people of adjacent village. It was recorded thoroughly from everywhere and mostly negative results have been achieved. It was the same case with KTWR.

The collection of grass from the reserve has created food reduction of wild life. The livestock, which grazes inside the reserve, transmit the disease to wild water buffalo. As ***Royal Nepal Army*** (RNA) guards the reserve, there is a close interaction between army and the local people. The local residents do not have good relation with the army and it causes the conflict. Similar results were found by ***Sah (1997), Heinen (1993), Thapaliya*** and ***Tiwari (2000).***

The study shows the conflict issues between the residents and the reserve, the main issues of conflict being crop damage, human harassment and biased mentality (approach) of reserve officials regarding different people. Likewise, live stock grazing, collection of drift wood, resource utilization, hunting, poaching and fishing inside the reserve is another aspect that results in conflicts. These conflicts started at the beginning of the formation of the park. Only the conflict measures are different but the issue can never be stopped ***(Sharma, 1991).***

More over the maximum conflict has been observed in the

eastern region of KTWR than the western region mainly due to the big damage of crops by wild water buffalo. People of eastern region also have complaints against soldiers, reserve staffs and wardens which are rather less in western region.

***Upreti (1985)*** has studied the Park and people conflict in National Park and wildlife Reserve of Nepal. He found crop damage, encounter between man and wildlife, Fishing and hunting, loss of live stock by predators and the tourist flow as the main issues for conflict between NP and Park neighborhoods. Many workers like ***Sharma (1991), Sah (1997),*** and ***Heinen (1993a)*** supported such studies.

The firewood shortage in the villages adjoining the Park is rapidly growing and may quickly reach the level of becoming Nepal's worst firewood deficit areas. Because these villages are located next to the park forests, a further shortage would inevitably lead to increased illegal exploitation of wood from the park. This is potentially a serious element of conflict with the local people that may jeopardize the very existence of the park. The firewood shortage has been approaching a crisis proportion in many parts of the country ***(Sharma, 1991).*** Therefore, it seems logical that KTWR should be directly involved in managing resources, co-ordinating community forestry programs, and other associated programs in the buffer zone. The conflict arises not only through the ban of the extraction of fuel from the Reserve but also because people have been denied their right to collect driftwood within reserve area. The Koshi River carries a large amount of firewood, which was collected by the people in that region prior to the establishment of the wildlife reserve. Since there is a prohibition of this activity inside the reserve now, the driftwoods travel further downstream where people living near the Nepalese-Indian border

would collect it.

Fishermen are mostly landless, and fishing is the only source of income for them. Such fishing activities are totally prohibited inside the reserve. They have no other option than fishing inside the reserve illegally, giving rise to a conflict between reserves and its neighborhood.

Fish farming is one of the major economic activities in ***terai***. The most common area for fishing is near the ***Koshi Barrage***. Escape stream and marshes on the east of reserve is advantageous to use the fishing gear of latest technology. All fishermen family members can be more profitably employed if better technologies are introduced to pisci-culture and related industries ***(Thapaliya*** and ***Tiwari, 2000).***

Many poor people take risks of being fined and poach in the reserve to earn extra income. In addition, some people of higher socio-political status carry out illegal hunting. The poachers are sometimes caught by reserve staff or soldiers and penalized nominally. The establishment of wildlife Reserve has restricted access to collect the resources inside the reserve. The regulations of the reserve prohibit activities such as grouping of livestock, exploitation of any kind of vegetation resources or setting fire on those resources, clearing land for agriculture or residential use, harming any animals and even walking inside the reserve without written permission from the warden's office. If someone enters illegally, he or she is penalized from ***5 NRs*** to ***one thousand NRs*** and will also have no provision of compensation. It also gives the negative approach towards the reserve ***(Warden's office).***

The HMG has launched PPP with the financial support of ***United Nations Development Program*** (UNDP) in 1996. This program works in consolidating the community initiative for sustainable bio-diversity conservation. This was quite effective at the beginning for reducing park and people conflict. But now, the residents of buffer zone are not as happy as in the beginning. The Explore Nepal is also actively participating in the conservation of bio-diversity and reducing park people conflict by fulfilling some of their basic needs by establishing school and constructing buildings for school. Few health care projects and ***King Mahendra Trust*** have been initiated to reduce the conflict.

Some of the respondents were quite happy with the establishment of the reserve. Their happiness towards the reserve is because of the various development activities and program from donor countries launched in the village. Flow of tourist should be high due to which the village will be highlighted and priority for employment will increase. Study in Cameron in the ***"park and people conflict"*** by ***Njiforti*** and ***Tehamba (1996,*** *cited from* ***Majpuria, 1998)*** concluded that the conflict arises by ignoring the interest of the local people. Similar conclusion was reached from this study.

In KTWR eutrophication was found in most of the wetlands caused by plants like water hyacinth. These plants, after dying, form sediment resulting in the reduction of the depth, slowly converting wetlands into marshes and later terrestrial fields. ***Shrestha (1994)*** and ***Bhandari (1998)*** studied introduction of exotic fishes on few ponds. They had studied the drainage, dragging for outlet and concluded the cause of wetland reduction. High-power water pump also causes reduction of wetlands. But, this work showed other

reasons as the main source of wetland reduction. The major sources of retrogression of wetlands are due to their poor management and flooding of Koshi river. Besides, there is a lack of awareness amongst the local people about the importance of such wetlands. ***Bauer (1987)*** reported that the monsoon flood in KTWR washed away wild life including wild water buffalo and newly released ***Ghahrial. Sah (1997)*** and ***Sharma (1991)*** took illegal grazing as a major threat to the wildlife degradation. But now- a- days this opinion is slightly diverted. It was found that the source of degradation of wildlife is mainly through the hunting, poaching and grazing of livestock inside the reserve with the huge quantity ***(15 to 20,000 of cattle)***. The poor socio-economic condition of the villagers around the reserve counts as the major cause for vegetation degradation. They cannot afford the expensive alternative sources of energy, which was observed in the study. Due to the lack of fence, local people can easily enter and cut the trees. Grazing animals, timber firewood, grass fodder extraction and illegal encroachment on the forest areas are the other causes for vegetation degradation. One of such study was carried out by ***Sharma (1991)*** in his work ***"Park People Interaction In Royal Chitwan National Park"***

Live stock population outside the reserve is almost stable but declining of domestic buffalo's population can be considered as a welcome sign for the management of reserve. In comparison to domestic buffalo, other livestock should not be considered entirely negative. Other live stock at least make their own herds and is not concerned with wild water buffalo and the pattern of feeding is also not similar. The park policies that attempt to reduce domestic buffalo and other livestock in the park neighborhood may not be desirable because the cattle produce the basic needs for subsistence

agriculture. The aim should be to encourage farmers to adopt appropriate technologies that can help to increase the efficient use of agricultural by- products. That simultaneously encouraging the planting of fodder trees and grasses on private lands, so that an optimum fodder trees and grasses on private lands and optimum population for the available resources can be maintained. This view was given by ***Sharma (1991)*** from ***Royal Chitwan National Park*** and is almost relevant to this works.

## CUTTING OF THATCH GRASSES (*Imperata cylindrica*) :

The ***Thatches*** (*Imerata cylindrica*), of ***Graminaea family***, has greater importance as it is used in large scale in house constructions. As it grows better and in abundance in marshy land or wetland, it is a common weed of KTWR. Though a simple weed, it has great significance as one of the most important economic grasses. That is why the local people want to collect it in large quantity. This grass has hard stem with the height of about ***3-4 meters*** making it an appropriate shelter for large number of wetland wild animals, including *Bubalus bubalis*.

About ***12%*** complained that the thatch grass (*Imperata cylindrica*) cutting period of ***7 days*** was not enough. Most of the grass cutters have complained about the Army staff and the Warden's office because the issuing of coupon for grass cutting is always delayed. The reason of delay was frequent cutting of all useful grasses before issuing the coupon. The ***7 day*** period of grass cutting in each year is not enough and has to be extended from ***15 to 20 days***. A strict rule for grass cutting has to be made. Some staffs are corrupted and they get the grasses for themselves in low price using few lower staffs to cut the grasses. These grasses in turn are sold. This should be strongly

prohibited improve the relationship between park authorities and neighborhoods.

About ***90.2% people*** want the grass cutting management inside the park to be improved whereas only ***9.8%*** of the people are satisfied with the existing policy. For making new policy, it is quite vague. People themselves can participate for improving the management practices. Eight entry points are not sufficient for grass cutting period. It was found that during the time of grass cutting, few more other points could be added so that illegal entry inside the park can be controlled.

In grass cutting period, firewood and other useful fodder for the wildlife are also harvested due to which the habitat of protected species *Bubalus bubalis* and other wildlife have been disturbed. Hence, such type of activities should be strictly prohibited inside the park in grass cutting period. The wildlife enjoys in the shelter mostly in summer, and the grass cutting in the summer disturbs the wildlife and causes solely negative approach to the theme of reserve. To the improvement of reserve; illegal activities on the reserve, political pressure to the wild life staff should be strictly avoided. Some trees have unused branches which are generally used for firewood and some trees can be pruned year to year inside the reserve. These unused branches can also be sold in small prices to the local people and help to reduce conflict or it may be provided in grass cutting period due to the interest of the local people.

Near about ***24 km*** from the Tappu boundary, the village should be started for the buffer zone. This economical support from the KTWR to the neighbourhood can be increased by the elaboration of the reserve area. Hence the grassland can also be extended. People up

# CONCLUSION AND RECOMMENDATION

# Chapter-6 CONCLUSION AND RECOMMENDATION

## CONCLUSION :

It is clear from the finding of this study that conflict of Koshi Tappu region centers around the use of the reserve by local communities. Priority ethnic groups have been demanding a greater share of economic resources with political people. Hence, the planners should have been aware of possible potential ethnic conflict. While making any decisions, they should have taken into consideration the welfare of the people in the park neighborhood. Residents at the buffer zone should have been asked to stop illegal livestock grazing, collection of firewood and thefts from the reserves and this should be effectively applied on KTWR as well as in the forests and grassland of impact zone. The important cash crop ***Sunflower*** (*Helianthus annus*) is least damaged as it is disliked by wild water buffalo (*Bubalus bubalis*), which is the main endangered species of the reserve. Motivation of the people towards sunflower farming can also reduce the conflict between parks and its neighborhood.

This study has concluded that the interaction between the park and people are positive as well as negative. Among positive and negative interactions, prevailing, the negative interactions are numerous, which in turn have resulted in conflicts in the park. Positive interaction of the park mainly concerns with the flow of tourists, use of fodder grass, firewood, logs and fishing, crossbreeding by wild water buffaloes and some other resources of reserve.

Hence, for proper management of the reserve and to meet the

objectives of its establishment, there should be sound relationship between park authority and neighborhood. It comes through some give-and-take policy, which helps to the sustainability of wild life conservation also.

This study was mainly conducted in buffer zone of the reserve while the secondary data has been used for studying inside the reserve. The questionnaire for ***12 VDC*** of buffer zone solely concern with the population variation, socio economic condition, wildlife depredation and the livestock population. PRA used mainly for the population variation of wild water buffaloes, park officials and junior staffs were also interviewed to know the preventive measure of conflict between park and people. The buffer zone of KTWR is poor in economic condition so the crop depredation by wildlife makes it very difficult to live there and that raises the conflict between residents and reserve. That is the primary conflict of park and people. The secondary conflict arises from livestock grazing inside the reserve. Obviously, it is against the reserve rules and human harassment by the wild animals also counts in such issue of conflict. The fishing, fuel collection, fodder collection, drift wood collection, hunting and poaching are also the main causes of conflict. Despite these, there is no provision for compensation for wild life depredation. Discrimination on penalty for illegal entry of livestock inside the reserve and strict prohibition to the entry for neighborhood inside the reserve is also a reason of conflict in KTWR.

KTWR has a very small area in the reserve where flooding is the major problem. The flora and fauna cannot sustain long due to this reason. The people of buffer zone generally use most of the vegetation

from the reserve. Some times they also poison the wildlife and fishes to catch them. At the time of flooding wildlife come out of the reserve and damage the crops. The proper demarcation between buffer zone and wildlife reserve is also not distinct. This results in illegal entry inside the reserve for vegetation and consequently causes disturbance to the wildlife, which should be stopped immediately. There are many physiochemical (like ***pH, temperature, salinity, humidity, rainfall*** etc ) factors that cause large fluctuation of diversity in the reserve. Frequent monitoring of such variable parameters and ascertaining if the existing parameters are harmful or not, can also control this type of fluctuation. If some parameter is negative to the flora and fauna of the reserve, there should be more consciousness. Besides, the lack of fodder grasses inside the reserve also encourages the wildlife for migration outside into the buffer zone.

In the present study it was found that Wild water buffaloes and wild boars were found to be the main wild life pest in KTWR. About 65% of crop is damaged by wild water buffalo while ***10-12%*** by wild boar and very small amount by other wild animals while other reasons for the damage are flood in summer, ineffective physical barrier, food and shelter scarcity inside the reserve, disturbances by humans and live stock, vehicle driven inside, carelessness of wildlife staff, lack of proper scientific thought towards the wild life and the palatable taste of agricultural product.

The KTWR has various attributes, which attract the tourist from all over the world. This reserve has a special significance of its own. Wild buffaloes and birds signified the prospect of Eco-tourism. KTWR holds a good prospect and potentiality as a tourist centre and the

government has decided to develop it further. KTWR is not getting the expected number of tourists. The main reason behind it is that the best time to the tourists can not visit the place throughout the year, as it is open in seasonal (October to March). Lack of connecting roads and electric supply are reasons for not reaching the target of tourist inflow in KTWR. Thus, development of Eco-tourism is a good option for the economic growth of buffer zone. Majority of the residents also have a positive opinion on it. On the whole, tourist flow depends on the provision of essential infrastructure in this region. The migratory and resident national birds and water buffaloes found in the reserve are the main attraction of tourists. The maximum income of the park comes from elephant riding. About ***50*** to ***60 thousand NRs/year*** comes from elephant riding, ***400,000 NRS/year*** from Jungle driving, and about ***2,25000 NRs/year*** from grass cutting has been recorded in KTWR (***warden office***). Besides these, entry fee from foreigners ***500 NRs/day***, SAARC country personnel, ***200 NR/day, 20 NRs/day*** for ***Nepali*** and vehicle entry fee also help to add the income of KTWR. This income from tourism can be increased with improved management.

The population of wild water buffaloes is mainly decreased by monsoon flood, which sweeps off calves of wild water buffaloes. This is why there is yearly inconsistency in the population of wild buffaloes. The land of the reserve is also not sufficient for its extension, especially in the southern part up to the Koshi barrage. In the eastern part, it is important to extend ***300*** to ***500 m*** to give them a sufficient home range (Warden's office).

The number of endangered species *Bubalus bubalis* can be

protected and increased by using well-defined boundaries of wild life reserve. The reserve can be divided into four zones for its proper management.

- Protected zone
- Conserving zone
- Pasturing zone
- Buffer zone

Among the above zones, protected and conserving zone should be strictly prohibited for human activities, live stock grazing, and vehicular disturbances. This can help to minimize diseases caused by domestic cattle, competition for food and poaching activities inside the reserve. Fishing activities and other stray animals affect the gene purity of wild water buffaloes. Pasturing zone should also be strict like the protected and conserving zone. But it should provide only seasonal grazing for residents of adjoining villages. Buffer zone is already limited and it should keep out from the reserve areas using fencing around the reserve to enhance the safety for this endangered species *Bubalus bubalis*.

Translocation and restoration of wild water buffaloes in Nepal are equally important as they have low population. Translocation is not the only remedy of this problem because there are still about 461 species of birds sheltered by the reserve, belonging to ***58 families. Likewise, 30 species of mammals, 46 species of herpeto fauna,*** and ***77 species of butterflies*** have also been facing the problem of shelter, food and breeding. That is why it has been recognized as a wetland of importance and included in the list of "Ramsar sites". There

is a large number of such ***flora*** and ***fauna*** scattered all over the wetland of KTWR.

During our field visit we saw the residents themselves killing the buffaloes. Such activities really threaten wild water buffalos and challenge wildlife staff as well as the security staff of the reserve. Livestock grazing, land use changing pattern due to flood, poaching and hunting are the other aspects of threats to the population of wild water buffaloes.

There are some families of ***Yadav communities***, who still keep thousands of domestic buffaloes and other livestock inside the reserve. Perhaps they have good relationship with the reserve staff. But such a good relations threaten the gene purity of *Bubalus bubalis*, sheltering, breeding and feeding pattern of other wild species of the reserve. In the mean time, farmers from poor families are deprived from grazing their cattle inside the reserve and they have to pay fines if the reserve staff catches their cattle. Such type of discrimination is always harmful for a flourishing ***National Park*** or reserve.

The grass-cutting program in KTWR has contributed the economic benefit for the people of buffer zone indirectly to the nation. The main grasses of KTWR are *Imperata cylindrica*, *Phragmites karka*, *Saccharum spontaneaus* and *Verteveria zizanoids*, which are present in most parts of the reserve area. *Imperata cylindrica* prefers to grow in dry land in comparison to other grasses. These grasses are observed in large amount in January and lesser in April and May. The most suitable time to allow people to cut grass inside the park is from mid Dec to mid Feb. It is because the moisture content of the plant is

also least in such period due to low rainfall. In the grass-cutting period, the large flow of people inside the reserve tends to disturb the wild life of the reserve. This disturbance inside causes negative approaches to the reserve's ecosystem. Flow of people inside may be reduced by strictly regulating entry from the official entry points. Such permission should be implemented year to year according to the prevailing needs.

Entering from unofficial points should be monitored and illegal entries should be discouraged. The people have also demanded to collect some firewood from the reserve, which can be considered in grass cutting period by giving them unused small dry branches of the trees. KTWR is really an important habitat for the ***wild water buffalo*** (*Bubalus babulis*). The latest record shows the population of wild water buffaloes to be **145 (Heinen, 2001)**. It can be increased by the protection of reserve ecology. For the protection of wildlife, people themselves should be motivated against the harmful activities towards the reserve. Sudden shifting on the position of Koshi River has also changed ecology of this area and the position of grassland in the reserve. Some grassland should be made for selling of grasses in grass cutting period, both for fodder and roofing. Entrance of vehicles, bullock carts inside the park in grass cutting period should also be restricted to protect the other vegetation and thefts of large size logs. In the grass-cutting period, attention must be paid to those resources, which are becoming short in supply.

Outside the reserve in buffer zone, there is much unused land, which can be used for community-based work. This land could be used for plantation of trees, grasses, and fisheries. Such works reduce

the dependency of people on the park for fodder. Illegal entrance in KTWR for grass cutting purposes could be checked by using the above activities.

It was concluded through this study that the existence of the wild life and bio-diversity inside the reserve is mainly threatened by nature on one hand and the government on the other. The quality of land is degrading year-by-year. Most of the farming system is also demolishing. Interests of the people have been diverted against positive thinking towards the reserve due to wild life depredation. In such cases the government should play the major role. But there is always the question raised by the people, what does the government do for the respondents? The government can do many things for reducing the conflict. As such, the government can take initiatives for the improvement of land quality, encourage fish farming, and farming of other cash crops like ***Sunflower*** (*Helianthus annus*) e.t.c. which could help in inducing people to think positively towards the reserve.

The government also can provide medicinal care and other different cares to the respondents. Priority should be given to poor people for food and shelter. It could also improve the reserve for entertainment, develop industries for the consumption of the local product and help the poor people get employment in the concerned area.

Setting up of agricultural industries, construction of link roads, establishment of schools and colleges, building construction in the buffer zone can also help to reduce the conflict and create positive attitude of respondents towards the reserve. If the government does

not protect the people's area then confrontation between the people of the buffer zone and the government will continue. Duty of government and the politicians representing such areas could be initiated for the improvement of life style and reducing the conflict between the reserve and its neighborhood.

If they increase the agricultural facility, provide fertilizer, insecticides, and pesticides at subsidized rate and share the views for new agriculture technology, their yield would improve the standard of life. Then definitely the people will safely raise the level of positive thinking towards the reserves. Bio-diversity can exist inside the reserve without disturbance which increases the tourist flow in KTWR. Actually, the conflict between the reserve and the people around the reserve is mainly due to food, shelter, and unawareness among the people. The problem of the conflict lies in hunger and lack of ways of earning livelihood.

Politicians representing the voters of this area are not found attentive to the peoples need. They do not raise their problems at public forum. The representative politicians of such places can do many things with the government. If they give first priority to education and insist on opening of educational institutes, it can be very beneficial for the voters.

Secondly medical facility and security of the respondents are also equally essential for making them think positively towards the reserve. Development of buffer zone area by the government viz the establishment of industries, linking of roads, drinking water and frequent monitoring will help to reduce the conflict between the

reserve and its neighborhood. Bio-diversity degradation inside the reserve, crop depredation outside the reserve, illegal grazing of livestock inside the reserve, and illegal planting and harvesting in the reserve is also a source of conflict between park and people. The positive thinking and perception of the neighborhood through the development of the area and government initiation can solve the conflict. Bringing out alternatives for the roofing of the respondent's hut can reduce the illegal grass cutting inside the reserve. For example, the roofing material can be manufactured by using plastic material, wooden plants and other cheap products of the concerned area.

## RECOMMENDATION :

The KTWR is located around the three districts of ***eastern Nepal, Sunsari, Saptari*** and ***Udaypur***. Before the establishment of this reserve, people of this district used the area for fuel wood, grass cutting, fishing, hunting, poaching and grazing of their cattle. But after the establishment of KTWR the conflict arose between the park and the people as the necessities of the people increased but restrictions disallowed them to enter inside the reserve area and dissatisfaction arose slowly and slowly. So to reduce the conflict between park and people, following important points are recommended.

a. To develop the sense of conservation among the local peoples and encourage them to develop the alternatives outside the park. This might help to minimize the pressure inside the reserve. The alternative should be to develop community forest,

fodder grasses, fish farming, hybrid Product of livestock, Industrialization, community based work, recreational activities, health care centers, educational activities and well developed transportation etc.

b. Government should compensate for the crop damages by wildlife (mainly by wild water buffalo) and should make proper management to provide a stable protection measure to prevent wild animals from coming out of the reserve. This could be achieved by proper fencing around the reserve boundaries. Some bamboo trees may also be used instead of fencing. Such trees are dense and protect the reserve from incoming and outgoing men and wildlife. The bamboo trees are also valuable for making paper hut, have high nutrition value for wildlife, and could be sold at good price. Fencing by bamboo planting around the reserve is strongly recommended for reducing the conflict.

c. Arrangement must be made to collect the fuel wood for the benefit of people, which flows through the flood water of Koshi River. In the time for collection of fuel, food etc., some entry provision inside the park should be maintained for the good relation between park and its neighborhood. The entry policy should be given priority of destination from the park. The distance where the park commences should be well defined and given higher priority.

d. Inspire the local people to tame a small numbers of hybrid buffaloes, cows and other livestock and encourage them to rear such cattle outside the reserve. The hybrids should have the

characteristics like minimum consumption of grasses, good milk production, high immunity, good sustainability etc. If possible, some subsidies to the respondents should also be given for rearing hybrid products.

e. Conflict between the park and people must be avoided. If it is not done, then the objectives and the goals of the parks cannot be achieved. To minimize the conflict and find the better output the following facilities to the local people should be provided.

PPP ***(Park People Program)*** was launched in the KTWR in 1994, which is funded mainly by UNDP. The program helps the people by providing the funds to solve the problems. On this programmme, people make groups and PPP provides some financial assistance for supporting their poverty elevation at a very low interest. This program was quite effective at the beginning, but slowly it became unpopular. Such types of programs, through ***Government Organization, Non-Government Organization*** and ***International Organization*** are strongly recommended to reduce the conflict. Increasing awareness of the people in regard to importance of wetlands, endangered species of bio-diversity, ecological balance ***(ecosystem)***, pollution and protection of culture and life style of specific ethnic groups of buffer zone are also strongly recommended.

To some extent, KTWR provides some financial aid to those families who lose their lives or suffer from damages caused by the wild animals. It also provides fuel wood for some occasions like funerals and rituals but it is not enough.

KTWR needs to provide the fuel wood, grasses, some medicinal

plants and other products of the reserve on the priority basis. Such priority should be given to the poorer and nearest families of the reserve. ***Wild life Department*** which is under the ministry of forest has also requested for financial support to the local people, for the compensation of crop damage, livelihood and for protection of cultural heritage of different ethnic groups.

School buildings, hospitals, temples, mosques, and other social institutions are also very important for the people of the buffer zone. In addition, some wood and logs should be provided on the recommendation of the village leaders for reducing the conflict between reserve and its respondents.

The huge number of domesticated buffaloes and calves are making a great disturbance to the wild buffaloes that create comparison for shelter and feeding territory of wild buffaloes inside the reserve. Due to this, wild buffaloes stray away from their territory and come out to the agricultural area. Removal of domesticated buffaloes and other livestock from the reserves will maintain the sheltering and feeding areas of wild buffaloes that is also recommended for increasing the number of endangered species ***(wild water buffaloes)***. On the other hand, scientific fencing, proper demarcation at the periphery of flood plain, controlling of flood, increasing the grass land of the reserve, elaboration of reserve area, afforestation inside the reserve, checking eutrophications of the wetlands will also help to increase the number of wetland bio-diversities and wild water buffaloes of the reserves.

Illegal cross breeding of *Bubalus bubalis* with the tame buffaloes

is also threatening the population of pure wild water buffaloes. Pure wild-water buffaloes were ***145*** in 2001 while the cross buffaloes were 131 in the reserve. Even after the establishment of the reserve, the growth rate of *Bubalus bubalis* population is very low which is because of such cross breeding. Therefore strict prohibition to the cross breeding with wild water buffaloes is recommended for the protection of pure gene of such endangered species. If it is not possible, few of these polygamous species can be kept in a particular place only for breeding purposes at a low cost. This scheme provides dual advantage. It helps the respondents on one hand while illegal crossing is prevented on the other. It also helps to protect pure gene from the wild water buffaloes.

In the rainy season all the doors of Koshi barrage should be opened so as to make maximum water flow without disturbances. If so, the floodwater may not clog this area. Koshi River carries maximum silt on its way. Hence in the depth, the silt accumulates rapidly and so the floodwater spreads throughout the reserve area creating disturbances to all the living organisms in their existence. Therefore the siltation of the Koshi must be removed for the protection of bio-diversity of the reserve.

The wild water buffaloes can be translocated to the other habitats like Koshi Tappu. But it is quite expensive. So, instead of translocation; area expansion, grassland extension inside the reserve and proper management of KTWR is also strongly recommended for the protection of gene purity of *Bubalus bubalis*.

Intensive research for wild water buffaloes in ecological aspect,

behavioral aspect, feeding aspect, adaptational aspect, and social aspect are also highly recommended. In the meantime, abundance of bird species, both migratory and residential, should be considered for specific research. This is the reason, the wetland habitat of KTWR is included in ***Ramsar site*** of the globe. So the specific research of any species inside the reserve is very essential for the sustainability and the existence of the KTWR.

In the grass-cutting period, entrance through the unofficial point is frequently monitored and such illegal activities should be checked. Providing official entry points and their strict monitoring may reduce the flow of the people inside the reserve. The people of buffer zone should be encouraged to keep some improved animals as they reduce the consumption of fodder grasses. There are many unused lands that can be used for community- based work. Such unused lands should be used for ***tree plantations, grasses for livestock, fish farming, fruits farming*** etc. This will reduce illegal grass cutting and also the dependency of people on the park for fodder.

Minority of ethnic groups will be demanding a greater share of economic resources through political persons. Hence the planners should be aware of potential ethnic conflict while making any decisions that affect the populations in the park neighborhood. The motivation of the people towards producing crops that are disliked by the wild lives is also recommended for inclusion in rotational farming system of buffer zone. As such, the ***Sunflower*** (*Helianthus annus*) farming can be considered as one of the important cash crop disliked by wild water buffaloes (*Bubalus bubalis*) in comparison to other existing crops.

KTWR has a very small area in the reserve where flooding is the major problem. The flora and fauna cannot sustain long due to such reason. The extension of the reserve area is strongly recommended for the sustainability of such biota inside the reserve. Some times people poison wild life and fishes in the process of catching them inside the reserve. For the protection from such poisoning, the reserve should be demarcated strongly by using iron pillars or cement blocks. The demarcation prevents the flow of the people inside the reserve.

Government regulation in solving and finding the problem of the respondents is very essential for the buffer zone. Government can do many things for the improvement of buffer areas and reserves. It can take into the confidence of local residents. It is strongly recommended that the Government should give priority to such area for the afforestation and launching popular programmes that may help to improve life style of the people of this place.

Awareness for the vocational education, mortality of wild water buffaloes through disease, importance of wild water buffaloes, birds and all biota of the reserve also come under the major recommendation for the conservation of such areas.

An important area used as a staging site for a number of bird's species lies near Koshi barrage which is situated outside the reserve. This southward place has no local problem because of absence of human settlements in such area. However, the extension would require governmental co-operation between Nepal and India. It is because the area is currently leased to the state government of Bihar, India for 199 years. Along the eastern boundary, ***400 to 500m*** wide,

running the center length of the wild life reserve is recommended for extension. The area comprises of the seepage stream and marshes, which is important for nesting the winter migratory birds. The area in the western boundary includes the ***Trijuga forest*** and a corridor joining the reserve with the dense forest should be expanded. Duck and other birds species require ***35 to 45 km*** walking area for movement in river side, where as the present area is less than half of the requirement, therefore the extension of the reserve area is more essential and highly recommended.

Frequently visited area by wild life should be continuously monitored. In such area, the reserve should provide preventive measures including effective noise-controlling tool and other destructing devices. A large expanse of water near the barrage and the main stream of the river seepage of the eastern side are important for fish stocking. The fish of Koshi has been found more tasty than other fishes. Fishpond in the eastern seepage may also help to confine wild animals inside the reserve. So the fishery development program should be given important consideration at the government level.

The existing small-scale rural industries like manufacturing of ropes, mats, baskets, stools and earthen pots should be promoted. ***Saccharam sps*** can be used as raw materials for paper production as low cost scheme. Agriculture based industry can also be developed for engaging the poor people of this area. Numerous vocational training like producing the quality product, plumbing, hair designing, electronics, carpet making and other useful training should be conducted for the target groups. The target groups are mainly considered for the land-less farmers, lower caste people, women and

interested people of that area.

KTWR has a great prospect for eco-tourism in their variation of bio-diversities and wetlands nature. Due to this reason, there should be a visitor center from where tourist can acquire information about the reserve. The local people should guide them, especially those who have good knowledge about the wild life reserve and its biodiversity.

Training the local people for operating hotel, lodge, and restaurant would also help to improve their socio-economic condition. The government should provide interest free loans to local people to encourage them to start such work.

Last but not the least, KTWR could be the historical reserve of Nepal which can be exemplified as one of the renowned wetland reserves, if the government initiates the improvement schemes of the reserve. All scientists, specific researchers, local residents, wild life staffs, Army staffs, GO, NGO, INGO and all the conservationists of the country are requested to work together to find the solutions to improve the reserves.

Govt. and local bodies should encourage creation of co-operatives involving the both park and border area residents, making them responsible and make them responsible for the development and that the residents should feel that they are a part of the Reserve. In other words they must feel that their own development and progress in linked with the development of the Park.

The Government of Nepal should also encourage the NGO's with all Physical facility and the money regard for operation in such

difficult terrain. The NGO's should go out and endeavour to develop a community feeling and awareness amongst the residence for development and protection of the park.

Govt. of Nepal must develop and establish mass contact with the residents of the KTWR and establish cottage industries based on the products available inside the park e.g. bamboo, grass based etc industries. Such industries will not disturb a affect the eco-system. Infact, it will be eco-friendly.

Govt. of Nepal organize regular tree plantation program in buffer zone area of the park. Some thing similar to ***Van Mahatsav*** of India. The trees preferably be fruit producing once and should be hardy, pest resistant etc for eg. ***berries*** (*baer in hindi*), ***Raspberry*** (*Makaya*), ***straw berry***, all varieties of ***Citrus***, ***Pineapple*** and ***Papaya*** etc. and pass on these trees to the residence of buffer zone for their care and mentainance. They shall pluck the fruit and sell it through the co-operatives.

Govt. should established fruit based industries in the buffer zone for the welfare of people; industries such as ***Juice making, fruit preservation, Jam, Jelly, souse making*** etc. These industries do not require heavy investment and expenditure and can be easily managed by the residence. ***Sikkim*** and adjacent Indian state having similar topography as Nepal has flourishing fruit based industry which is providing a good source of revenue to the state.

As an ancillary to fruit trees industry, the bee keeping should be encourage, this also provide good amount of revenue.

Lastly, some sort of a fencing is necessary to keep the wild buffaloes from straying into the buffer zone but fencing will involve lot of expenditure and maintenance . Hence, it is being purposed that a nature fencing be created by plating tall **cacti.** These provide a very good check for the animals free movement. This will also prevent illegal live stock grazing.

Therefore, all the above initiations and interactions should be co-linked by the DNPWC under the ministry of forest. This will reduce the conflict. Systematic grass cutting, existence of bio-diversities inside the reserve, positive feeling of people towards wildlife and the reserve helps to the sustainability of endangered species. At the same time, the damage of crops by wildlife and wildlife depredation will also be reduced to some extent in the buffer zone area. Encroachment of the areas in the buffer zone will be reduced. It is because of people's awareness and frequent monitoring at the government levels and providing them alternatives. Effective family planning programs and controlling immigration into the buffer zone are also recommended for balancing the rate of population growth in such area. All above recommendations could be helpful to reduce the conflict between the local residents and reserve authorities, to improve the park management, to protect the gene purity of *Bubalus bubalis*, and to sustain biodiversity in the reserve and finally to improve the socio economic condition of buffer zones of KTWR. This is why the work is solely concerned with the protection of endangered species and the improvement of socio economic condition of reserve's neighbours.

# ABSTRACT

# Chapter-7 ABSTRACT

Present work was undertaken to study the people concept towards conservation of wild life and forest Reserve. The study area is known as Koshi Tappu which is the only inhabiting area for ***wild water buffalo*** (*Bubalus bubalis*) in ***Napal***. Since the number of wild buffalo is fastly declining and became endangered species. To save its genetic pool, govt. established wild life Reserve in ***Koshi Tappu*** at ***Kushaha*** which was established in the year 1976. The Reserve has purposely been established for 1. The conservation of wild water buffaloes, which is becoming endangered. 2. Providing proper habitat for migratory and residential water fowls along with some important aquatic and terrestrial small animals.

Koshi wild life conservation area (Koshi Tappu) is named as the Koshi Tappu Wild life Reserve (KTWR). It lies on the flood plain of ***Sapta Koshi river*** in the eastern Nepal. It is the only one ***Ramsar*** site of Nepal. The area of Reserve is about **176-sq**. kms. and bounded by three district viz ***Sunsari, Saptari*** and ***Udayapur*** of two zones ***Koshi*** and ***Sagarmatha***. The study of the Reserve was carried out from January 1999 to August 2001.

The KTWR extends between $26^0$ 33`-$26^0$ 42` and $86^0$ 54`-$87^0$ 04` East as the flood plain of eastern ***Terai***. Numerous water holes and swamps has been created due to monsoon flood in KTWR. The extensive growing of ***Savanna*** type of creates an ideal place for feeding to ***wild water buffaloes*** (*Bubalus bubalis*) and other small animals. It provides a better habitat to birds for feeding and nesting.

The Reserve was also established for the conservation of bio diversities on the national or regional level. The result showed that people of this area are dependent on the Reserve for the collection of grasses, fuel woods, logs, medicinal plants and seeds which are occasionally and legally collected. Fishes from the Reserve are also sold cheaply in the local market. In spite of the all benefits from the Reserve, the people of the buffer zone are mostly poor. They do not understand the importance of Reserve and National parks. This negative attitude towards the Reserve is mainly due to illiteracy, religious discrimination, ethnicity, casts, crop-damage by wild life, and the poor socio economic condition. They need to be educated to understand its importance.

The following factors were taken to study the interaction between wild life Reserve and its neighbourhoods.

## THATCH GRASS CUTTING (*Imperata cylindrica*) :

The **thatches** (*Imperata cylindrica*) has great important as it is utilized at a large scale in the construction of house which grow in KTWR. Because, it grow better or more abundantly in marshy land or wet land. Though grow it as simpler weeds but has got the status as one of the most important economic grasses. That is why the people want to collect it in large quantity. This grass has hard stem with the ***hight*** of about **3** to **4** meter in which the most of the wild lives easily conceal themselves and used as a good shelter for ***Bubalus bubalis***.

The warden's office permits every year for one week to 10 days for cutting of its excessive grasses from the Reserve during the end of Dec to beginning of January of each year. ***Thatch*** grass (*Imperata*

*cylindrica*) is the main grass, which is used by every household for roofing purpose & also for marketing to earn some money or their own use.

## BIODIVERSITY :

The observation on various aspects of study shows that the KTWR is rich in biodiversity. The main protected species of KTWR is ***wild water buffalo*** (*Bubalus bubalis*), though the number of wild water buffaloes in the Reserves is also not increasing satisfactorily due to poaching, disease and the monsoon floods. It is the only place in Napal where wild water buffalo (*Bubalus bubalis*) is found. Wetlands with the ***thatch grasses*** (*Imperata cylindrica*) and sandy soil makes an ideal habitat for the ***wild water buffaloes*** (*Bubalus bubalis*). The wildlife diversity includes taxonomical group like ***protozoa, Cladocera, rotifera,*** and ***Copepoda.*** Likewise macro-invertebrates recorded were crustaceans, nematodes and insects of orders ***Orthoptera, Odonata, Diptera, Hemiptera, coleoptera*** and few ***gastropods***.

Besides the ***Bublus Bublis***, KTWR is extremely important for the conservation of other bio-diversity such as migrating water fowl. ***Axis axis, Boselphus tracolamelus, Vulpes bengalensis*** and ***Canis aureus.*** The other important ***vertebeates*** of KTWR were ***Anus, Python, Crocodylus, Puntius, Chela*** and the ***Calisa*** which are frequently observed. ***Saccharum, Imperata*** and ***Cymbopogan*** types grasses are the important vegetation of KTWR.

Over all the Reserve consist of **514** species of plant belonging to **99** families, **31** species of mammals, **461** species of birds, **117** species

of fishes, **46** species of **herpeto fauna** [*amphibian of reptiles*], and **77** species of butterfly. It also contains almost **17%** of animals, **50%** of birds, **63%** of fish **26%** of amphibians and reptiles of the country. Among the flora and fauna, some are occasional, some are common, some are rare and others abundant. The distribution of vegetation in the Reserve possesses **13%** of the flowering plants of ***Terai***, which is **4.7%** of the country.

## BUFFER ZONE :

The area surrounding the national park and Reserves is simply name as the buffer zone. Buffer zone is being ribbed in the form of agricultural land and grassland. The buffer zone of KTWR is dominated by cultivated land **(86.5%)**. The rest of grass land. Of grass land **6%** is covered by river, sand and boulders, **5.6%** by swamp and **0.6%** by orchard. The total buffer zone in the eastern sector covers **57%** and the western sector covers **43%** area. In contrast, total house holds residing in the eastern side is **44.4%** and in western side **55.7%**. Thus house hold on an average covers **1.52** ha. in the eastern sector and only **0.87** ha. on the western sector. Comparison of land use pattern of eastern and western side of buffer zone shows that the cultivated land covers **90.4%** on the western sector and **83.6%** in the eastern sector. There are **16 VDCs** included in buffer zone of KTWR, of which **12 VDCs** of **3** district were selected for the study, *viz.* ***Tapeshwori, Prakashpur, Madhuban, Kushaha, Shripur, Haripur, Odraha, Kamalpur, Ghoganpur, Pipra, Jagatpur*** and ***Badgama VDes*** of ***Udayapur, Sunsari*** and ***Saptari*** district.

In the buffer zone, about **87.3%** of the people are involved in

agricultural activities *i.e.*, **51.2%** are involved in farm activities including animal husbandry, **36.1%** of people are partially involved in agriculture and allied activities. Besides agriculture, **4.8%** are in trade, **6.8%** are in service and **1.1%** minority group are involved in agriculture labour besides their traditional occupation of fishing to supplement their minimal cash incomes.

## POPULATION :

The Causes of fluctuation in population in all 12 VDes of 3 districts studied are mainly due to immigration of people from hill area and near the border of India after the establishment of wildlife Reserve. It was found that maximum population increase and encroachment was shown in ***Tapeshwori*** and ***Prakashpur*** VDC's respectively. It is because of immigration of people from the adjacent hill area due to deteriorating resources there was no other option except migration for their livelihood is one of the major causes of increase in population. The decreasing population in ***Pipra*** seems to be due to certain forest Reserve restrictions, which has deprived extraction of resources from the Reserve, which lend migration of families from the **VDCs**.

The human population in buffer zone is about **270** per Km in the eastern and **278** people per km along western boundaries which is increasing slowly and now it is more than this ratio. Due to increasing such population densities, more problem raised for management of the Reserve in the commencing days. The socio-economic analysis of cost and benefits of local people of KTWR showed poor attitudes towards the ethnicity and illiteracy rate of people.

## CROP DAMAGE :

The crops in the buffer zone area are damaged due to the attack of animals from the Reserve area. ***Wild water buffalo*** (*Bubalus bubalis*) damages mostly crops *viz.* ***Paddy, wheat, millet, potato, pulses, sugarcane*** and ***Jute*** but on the other hand the male wild water buffalo provide the improve breeds through the cross sex with female domestic buffalo.

Besides the ***Wild water buffalo*** (*Bubalus bubalis*) ***Hog deer, Spotted deer, Jackal, Smooth coated otter, Indian fox*** and ***Wild boar*** are also reported as crop raider of buffer zone. The main cause of damage is due to lack of effective physical barrier between the border of buffer zone and Reserve. Food in the ***Koshi river***, minimum amount of fodder grasses inside, sheltering problem and Koshi river itself are the main reason of coming out the wild life from the Reserve.

However the ***Sunflower*** (*Helianthus annus*) plants are completely ignored by the wildlife. Therefore the ***sunflower*** (*Helianthus annus*) farming around the KTWR is the safe crops and be encouraged to the people around the Reserve. It is one of the good cash crop, the ***Helianthus annus*** farming should be encouraged to enhance income. It can grow well on such a tropical climate with sandy wetland. It is one of the main finding of this study.

## PARK PEOPLE INTERACTION :

The interaction between the conservation area and its neighbourhood are counted as usual procedure all over the world. In the KTWR, there are big conflict between the Reserve authority and the residents of its buffer zone. The main issues of conflict are being

***crop damage, human harassment, live stock grazing, collection of drift wood, resource utilization, hunting, poaching*** and ***the fishing*** inside the Reserve. The conflict started as soon as the proposal for establishing National park known to the people of buffer zone.

More over the maximum conflict has been observed in the eastern region of KTWR than the western region mainly due to the big damage of crops by ***wild water buffalo*** (*Bubalus bubalis*). People of KTWR also have complaints against soldier, Reserve staffs and wardens regarding their biased mentality of them.

Due to incomplete of fencing, local people could easily access to the Reserve and cut the tree and grasses which caused vegetation degradation. ***Grazing animals, timber firewood, grass fodder extraction*** and ***illegal encroachment*** on the forest areas are the other causes for vegetation degradation. For prevention of above activities by the authorities also have the major complain towards the Reserve staff by the people of buffer zone. As such, there was maximum conflict between wild life staff and people around the Reserve.

## SUGGESTION :

This present finding suggests some solution of the conflict between the park authorities and residents of buffer zone. To launch some popular programs in the neighborhood of the Reserve viz educational and health care programmmes, child care programmes, the family planning programmme, good communication and transportation programmme, industrialization, fish farming,

community based programme, agricultural based programme, and women's encouragement programme are strongly recommended to reduce the conflict between Reserve and its neighborhoods.

***Govt. of Nepal*** should start plantation program in buffer zone area of the park. Some thing similar to ***Van Mahatsav*** of ***India***. The trees preferably be fruit producing once and should be hardy & pest resistant for eg. ***Berries*** (*baer in hindi*), ***Raspberry*** (*Makaya*), ***Straw berry***, all varieties of ***citrus***, ***Pineapple*** and ***Papaya*** *etc.* and pass on these trees to the residence of buffer zone for their care and maintenance. Arrangement for marketing of their product through co-operations.

Govt. should established fruit based industries in the buffer zone for the welfare of people; industries such as ***Juice making, fruit preservation, Jam, Jelly, souse making*** etc. These industries do not require heavy investment, the expenditure can be easily managed by the residence. ***Sikkim*** and adjacent ***Indian state*** having similar topography as Nepal has flourishing fruit based industry which is providing a good source of revenue to the state.

As an ancillary to fruit trees industry, the bee keeping should be encourage, this also provide good amount of revenue.

Proper fencing of Reserve is necessary to keep the wild buffaloes from straying into the buffer zone. Hence, it is suggested fencing by planting ***Cacti*** would be economical for such a large area. These provide a very good check for the animals free movement. This will also prevent illegal live stock grazing.

Rearing of improved breeds around the surrounding of KTWR, and farming of highly economic cash crop, which is also disliked by the ***Bubalus bubalis***, like sunflower-farming be encouraged. The proper and efficient management of Reserve could be reduce the conflict between KTWR and its neighborhood.

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# APPENDIX

# APPENDIX –1

## Koshi tappu wildlife Reserve
## Questionnaire for General Survey

Question being asked on the basis of Heinen (1986) Translation from Nepali.

### "General Survey"

Name

VDC. .... . ... ..... Ward No. .. ..... ..... .. District . .. . ..... ..

Language..... Family No..... ..... .. ... Land . ..... .... .....

Religion ..... ...

Who have completed primary education. ..... no of cattle.. ..

| | | | | |
|---|---|---|---|---|
| Cow | Buffaloes | Goat | Pig | Ox |
| Sheep | Poultry | Duck | Peagon | Others |

Wild life that damaged more in, month & less in month ..... .. not more, not damaged in month least damaged animal..... .....non damaged animals... . .....The animals liking food.. ..... .. .....popular crop of the farm . . ..... ...least popular crop.... ... ....Tranplamtainon of farming per year. ..... .The fleribility of harmfulness of wild lefe ..... if it is less than pervious then why? ..... If it is increased why? ..... .....PPP have some advantage or not? ..... What is the solution for the protection of wildlife in reserve? ..... . ..... .. ..... ..... .. .. ..... ..... . ... . ... ..... ..... ..... ... ..... ..... .....

The most animals for the crop..... ... .....

The most damage of the crop.... ..... ... ... .....

The products which discarded due to wildlife.....

Any New crops is being introduction the protection by wildlife? ..... ... ..

What is your view or suggestion about wild life Reserve ? .... .....

# APPENDIX –2

## "Questionnaire for Thatch Grass (*Imperata cylindrica*) cutting survey"

Name.....

Religion ..... ..... Caste.. ..... .. Distance upto Reserve. ..... ... .. ... ..... Type of grass to be collected . .. ..... aim of collection.. . .....Any thing more that can be got from reserve?

Why do you like Reserve ?..... .. .. .....

No of cattle you have. ..... .. ... . ... .....

Cause to dislike reserve .. . .. ..... ..... .....

To what extent cattles are being sent into Reserve?

What is the easiest measure to conserve water buffalo ? What might be the number of Water buffaloes, what is the present status of water buffalo.

i) If Growing why ?.... .... ..... ..... .....

ii) If Depleting ..... .. Why? .. ..... ..

What sort of relation is being established between Reserve & public?

Good/ Not good ..... .. ..... ..... .

If not, how to improve . .. ..... .....

Suggestions: ..... .. ..... .. . .....

# APPENDIX –3

## Koshi tappu wildlife Reserve
## Questionnaire for Socio econimic Survey

Household Questionnaire

Name.....

VDC..... .....Date... ..... ....Ward.....No..... .....Education. ..... .. .. . .

....Village.... .....Sex..... ..... . ..... ....Age. ... .....Occupation . ... ... .. . . ....

1. How much land do you own? Bigha ..... Kattha..... .Dhur.... .... . .
2. How far is your field from the reserve? .....Km.....Meter .....
3. Give the name of crops planted in your areas

| | Crop | land | Yield |
|---|---|---|---|
| a) | Paddy | ..... | ..... . |
| b) | Maize | ..... | ..... .... |
| c) | Wheat | ..... | ..... |
| d) | Millet | ..... | ..... ... |
| e) | Potato | ..... | ... ..... |
| f) | Sugarcane | ..... | ..... . ... |
| g) | Mustard | ..... | ..... |
| h) | Vegetable | ..... | ..... .. |

4) Do the animals cause trouble? (a) Yes..... (b) No.....

Name the most and least trouble causer?

a).....b).....c). .....d).....

5) Name the crops damaged and its quantity ? in quintals

a). ..... b)..... ..... c)..... d).....

| | | | |
|---|---|---|---|
| a) | Paddy | . ..... . | ..... ... |
| b) | Maize | ..... | ..... .. .. |
| c) | Wheat | . . ..... | .. ..... .. |
| d) | Millet | .... ..... . | ..... ... ..... |
| e) | Potato | ..... ... | ..... ..... .. |
| f) | Sugarcane | ..... . | ..... |
| g) | Mustard | ..... | ..... ... |
| h) | Vegetable | ..... | ..... ..... |

6) How frequently is wildlife seen in your fields ?

a) ..... ... ... ..... b).... ..... c)..... d)..... .....

7) At what time do they come mostly

a)..... b)..... c) ..... d).....

8) What have you done to protect crop damage?

How do you chase them?

9) Which is the time to visit your field?

a) Morning b)Evening c)Night d)Whole days

e) Whole night f)Whole day and night.

10) Has the wild animals attacked or killed any one in your family ?

a)yes b) no.

11) Have you entered the reserve? .....

12) So the wild animals attack you ?.....

13) Are you benefitted or harmed from the reserve. .. .....

14) What's your suggestion of wild animals are they protected or killed?.. .

15) Have you ever complained to park authorities about damage of your crops?..... ..

16) Are you satisfied with the current management of reserve ?. .. Are they doing something for people of buffer zone? ..... .....

17) Where do your live stock Graze ..... ..... ..... ..

18) What are the main solutions to increase the number of wild water buffalos inside the reserve?

19) How many Cattle do you have?

20) What do you think about cross breeding between domestic buffalos and wild water buffalos?

21) What is Your opinion about the translocation of Arna from KTWR?

22) What will be the major solution to sustain the bio-diversity inside reserve?

23) How can we protect purity of gene of Arna?

24) Give the suggestions for making good relations between reserve and its respondents ?

NB. Question No. 20 – 24 is related with PRA technique with political leader, teachers, groups of respondents and warden office.

# APPENDIX –4

## Koshi tappu wildlife Reserve
## Flora checklist

| Taxon/Family& scientific Name | Common Name Status | Local Name | Habit (Habitat) | |
|---|---|---|---|---|
| **PTERIDOPHYTES** | | | | |
| **ASPIDIACEAE** | | | | |
| *Diplazium esculentum* (Retz )Sw. ax Schrad. | | Lamtusia, Niuro | H(WD) | 2 |
| **MARSILEACEAE** | | | | |
| *Marsilea minuta L* | | Charpate | H(WD) | 1 |
| **OPHIOGLOSSACEAE** | | | | |
| *Ophioglossum reticulatum* L | | Jibhiya Sag, jibre sag | H(WD) | 2 |
| **POLYPODIACEAE** | | | | |
| *Adiantum Philippense* L | | Ratjan | H(WD) | 3 |
| **SALVINIACEAE** | | | | |
| *Azolla imbricata*(Roxb.) Nakai | | Pani Unyu (water fern) | H(WD) | 1 |
| **EQUISETACEAE** | | | | |
| *Equisetum debile* Roxb. ex Vaucner | Fiwld norsetail | Kurkure, Ankhe jhar | H(WD) | 2 |
| **LYGODIACEAE** | | | | |
| *Lygodium flexosum*(L.) SW | | | H(FL) | 2 |
| **PARKERIACEAE** | | | | |
| *Ceratopteris thalictroides* (L.) Brong. | | Pani dhaniya | H(WD) | 3 |
| **HELMINTHOSTACHYACEAE** | | | | |
| *Helminthostachys zeylanica* (L.) Hook | | | H(FP) | 4 |
| **POLYPODIACEAE** | | | | |
| *Drynaria quercifolia* (L.) Smith | | | H(FP) | 3 |

| | | | | |
|---|---|---|---|---|
| **PTERIDACEAE** | | | | |
| *Pteris vittata* L. | | | H(FP,WD) | 1 |
| *P wallichiana* Ag. | | | H(FP,WD) | 1 |
| **ANGIOSPERMS-DICOTS** | | | | |
| **ACANTHACEAE** | | | | |
| *Dicliptera bupleuroides* | | | H(WD) | 3 |
| *Echinacanthus attenuatus* (wall.ex nees) Nees | | | H(FP) | 3 |
| *Eranthemum pulchellum* Andrews | | | H(FP) | 3 |
| *E splendens* T. Anders Hort. ex | | | H(FL) | 3 |
| *Hemigraphis hirta* (Vahl) T.Anders | | | H(WD) | 3 |
| *Hygrophila aunculata* (schunacn ) Heine | | Gokhula-Kaant | H(WD) | 2 |
| H. polysperma (Roxb.) T. Anders | | | H(WD) | 2 |
| *Justicia adhatoda* L. | Malabar nut | Asuro | S(FL) | 3 |
| *Justicia procumbens* L. | | | H(FL) | 3 |
| *Lepidagathis incurva* Buch-Ham ex D. Don | | | H(FP) | 3 |
| *Nelsonia canescens* (Lamk.) Nees | | | H(WD) | 2 |
| *Peristrophe bicalyculata* (Retz) Nees | | | H(FL) | 2 |
| *Ruelia tuberosa* L. | | | H(WD) | 3 |
| *Rungia parviflora* (Roxb) Nees | | | H(FL) | 2 |
| *Thunbergia Fragrans* Roxb. | | | C(FP) | 3 |
| *T. grandiflora* (Roxb. ex Rott.) Roxb | black eyed susar | Kag Chuchche | C(FP) | 3 |
| **AIZOACEAE** | | | | |
| *Mollugo lotoides* L. | | | H(WD) | 3 |
| **AMARANTHACEAE** | | | | |
| *Achyranthes aspera* L | chaft flower | Chirchiri Apamarg Datiuan | H(FL) | 2 |
| *A bidentata* Bl. | | | H(FL) | 3 |
| *Alternanthera paronychioides* St | khaki weed | | H(WD) | 3 |
| *A philoxeroides* (Mart) Gnseb | khaki weed | | H(WD) | 3 |
| *A sessilis* (L.) DC | khaki weed | saranchi,Bhiringi Jhar | H(FL,WD) | 2 |
| *Amaranthus spinosus* L. | spinypio weed | kataiya kanojae Luae | H(FL) | 2 |
| *A tricolor* L | chinise spinach | Lude | H(FL) | 3 |
| *A viridis* L. | pig weed | Lude | H(FL) | 2 |
| *Celosia argentea* L. | | | H(CW) | 2 |
| *Deeringa amarantnoides* (Lam) Merr | | | H(FL) | 2 |
| *Gomphrena celosoides* Marr | | | H(FP) | 2 |

| | | | | |
|---|---|---|---|---|
| **ANACARDIACEAE** | | | | |
| *Mangifera indica* L. | Mango | Aan | T(CW) | 3 |
| **ANNONACEAE** | | | | |
| *Miliusa velutina* (Dunal) Hook. F.& Thoms | | | T(FL) | 4 |
| **APIACEAE** | | | | |
| *Centella asiatica* (L.) Uro | indian pennywort | Ghotapre | H(WD) | 2 |
| *Hydrocotyle sibthorpioides* Lamk | sano ghodtapre | | H(WD) | 2 |
| *Oenantnae javanica* (BI.) DC | | | H(WD) | 3 |
| **APOCYNACEAE** | | | | |
| *Astronia scholaris* (L) R. Br. | Devil's tree | Chhatoun | T(FP) | 3 |
| *Cascabela thevetica* (L.) Lippold | | | T(FL) | 4 |
| *Holarrhena pubescens* (Buch -Ham ) Wall ex . Don | | Dudhkona, madishekhirro | T(FP) | 3 |
| *Ichnocarpus frutescens* (L.) R Br. | | Gahumani | C(FP) | 3 |
| *Thevetia peruviana* (Pers.) K. Schum | | | S(FL) | 3 |
| **ASCLEPIADACEAE** | | | | |
| *Asclepias curassavica* L. | Blood flower | Khurahe phool | H(FL) | 3 |
| *Calotropis gigantea*(L.) dryand | Swaliow wart | Akon, Ank | S(FL) | 2 |
| *C procera* (Aiton) Dryand. | Swaliow wart | Akon, Ank | S(FL) | 3 |
| *Cryptolepis buchanani.* Roem& Schult. | | | C(FP) | 3 |
| *Cynanchum callialata* Buch.-Ham ex Wt. | | | C(FL) | 3 |
| *Oxystelma esculentum* (L.f.) Smith | Wild buffalo hom | Ama singe laharo | C(FL) | 3 |
| *Pergularia daemia* (Forssk.) Choiv | | | C(FL) | 3 |
| *Tylophora tenerrima* Wight | | | C(FL) | 1 |
| **ASTERACEAE/COMPOSITAE** | | | | |
| *Ageratum conyzoides* L. | Goat weed | Rawune, ilame, Gadhe | H(FL,WD) | 1 |
| *A houstonianum* Miller | | Nilo Gandhe | H(FL) | 2 |
| *Artemisia dubia* wall. ex Besser | indica worm | Titepati | H(FL) | 3 |
| *Bidens bitemata* L | | | H(FL) | 3 |
| *B pilosa* L kuro | | | H(FL) | 3 |
| *B sulphurea* (cav.) sch.-Bip | | | H(FL) | 3 |
| *Breea arvensis* (L) Less | Russian thistle | Thanka | H(FL) | 2 |
| *Blumea lacera* (Burm.f.)Dc. | Blumea | | H(FL) | 2 |
| B.membranacea dc. | Blumea | | H(FL) | 3 |
| *B. mollis* (D.don) Merr | Blumea | | H(FL) | 2 |
| *B. oxyadanta* dc. | Blumea | | H(FL) | 2 |
| *Caesulia axillaris* Roxb. | Thukaha | | H(WD) | 2 |
| *centipeda minima* (L) A.Br.& Aschers. | | | H(FL) | 2 |

| | | | | |
|---|---|---|---|---|
| *Chromolaena odorata* (L)king &Robin | Banmara | | S(FL,FP) | 1 |
| *Conyza bonariensis* (L) cronq. | | | H(FP,FL) | 4 |
| *C. canadensis* (L) crong | | | H(FL) | 4 |
| *C. japonica* (Thunb) Less. ex Dc | | | H(FL) | 3 |
| *Cotula hemispherica* (Roxb.) Wall. ex Cl. | | | H(FL) | 3 |
| *Crassocephalum crepidioides* (Benth) Moore | | | H(FL) | 4 |
| *Cyathocline purpurea* (Buch.Ham. ex D. Don) | | purple bane | H(FL) | 2 |
| Kuntz | | | | |
| *Eclipta prostrata* (L) L. | False daisy | vangril | H(FL) | 2 |
| *Emilia sonchifolia* (L.) DC | | | H(FL) | 2 |
| *Elephantopus scaber* L. | | sabsoria, Mulapatey | H(FP) | 3 |
| *Eupatorium adenophorum* Spreng | crofton weed | banmara | H(FP) | 3 |
| *Gnaphalium polycaulon pers.* | | | H(FL) | 2 |
| *Grangea maderaspatana* (L.) ploir | | | H(FL,CW) | 2 |
| *Gynura nepalensis* DC. | | | H(WD) | 4 |
| *Ixeris polycephala* Cass. | | | H(FL) | 2 |
| *Launaea asplenifolia* (Willd.) Hook | | | H(FL.CW) | 2 |
| *Mikania micrantha* Kunth | | | C(FL.FP) | |
| *Parthenium hysterophorus* L. | | | H(FL) | |
| *Pseudognaphalium luteo-album* ssp. affine (D.Don)Hillard & Burtt | Golden cud weed | Kairojhar | H(FL.CW) | 3 |
| Siegesbeckia onentails L. | Titiya | | H(FL.CW) | 3 |
| Sonchus asper (L.) Hill | | | H(CW) | 3 |
| *S. wightiana* | | | H(FP) | 3 |
| *Sphaeranthus indicus* L. | globe thistle | Lactogens | H(FL) | 2 |
| *Synedrella nodiflora* Gaertin | pirpire | | H(FP) | 2 |
| *Spilanthes acmella* (L) Murr | pirpire | | H(FP) | 2 |
| *S. clava* Dc | | | H(WD) | 4 |
| *S paniculatta* Wall.ex DC | | | H(FL) | 3 |
| *Tridax procumbens* L | | | H(FL) | 2 |
| *Vernonia cinerea* (L.) Less | Mirchiya | | H(FL) | 2 |
| *Youngia japonia* (L )DC | | | H(FL) | 2 |
| *Xanthium strumarium* L | Lapetuwa, bhede Kuro | | S(FL WD) | 2 |
| **BASELLACEAE** | | | | |
| *Basella alba* L. | indian spinaon | poye ke saag | c(FL) | 3 |
| **BIGNONIACEAE** | | | | |
| *Oroxylum indicum* (L.) Kurz | indiam trumpet flower | Patsan, Tatelo | T(FP) | 3 |

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| **BOMBACACEAE** | | | | |
| *Bombax ceiba* L. | Silk cotton tree | Simal,Sımar | T(FP.WD) | 2 |
| **BORAGINACEAE** | | | | |
| *Bothroospermum tenellum* (Homem).Fıscn & Mey | | | H(FL) | 2 |
| *Cynoglossum lanceolatum* Forssk | Houna's tongue | Kanike Kuro | H(FL) | 2 |
| *Helıotropium indicum* L. | Heathı-sur | | H(FL) | 2 |
| *H strıgosum* Willd. | Lapta | | H(FL) | 2 |
| **BRASSICACEAE / CRUCIFERAE** | | | | |
| *Rorıppa nasturtium-aquaticum* (L.) Hayek | | | H(WD) | 2 |
| *Rorıppa ındıca* (L.) Hıern | | | H(FL.WD) | 2 |
| **Draba elata* Hokk.f.ex Thoms | | | H(FL) | 4 |
| **BUDDLIACEAE /Asclepiadaceae** | | | | |
| *Buddleıa asıatica* Lour | Butterfly bush | Bhımsenpatee | S(FL.FP) | 3 |
| **BURSEARACEAE** | | | | |
| **Garuga Pınnata* Roxb | Dabdabe | | T(FL) | 4 |
| **CANNABINACEAE** | | | | |
| *Cannabis satıva* L. | ındıan hemo | Bhanga Ganga | H(FL) | 2 |
| **CAPPARACEAE** | Kabara | | S(FL) | 3 |
| *Capparis spınonosa* l. | | | | |
| *Cleome gynandra* L. | | | H(FL) | 2 |
| *C speciosa* Rafin. | | | H(FL) | 3 |
| *C vıscosa* L. | | hurhur | H(FL) | 2 |
| **CARYOPHYLLACEAE** | | | | |
| *Drymarıa cordata* L.Willd ex R & S | Lıghtıng weed | Abijalo | H(FL) | 3 |
| *Stelllarıa media* (L) Vill | | | H(FL) | 3 |
| **CELASTRACEAE** | | | | |
| *Celastrus panıculatus* Willd | pılaphai | | T(FP) | 3 |
| **CERATOPHYLLACEAE** | | | | |
| *Ceratophylium demersum* L | Hornwon | sewar | H(WD) | 3 |
| **CHENOPODIACEAE** | | | | |
| *Chenopodium album* | Lamb's quaners | Bathuwa | H(FL) | 2 |

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|---|---|---|---|---|
| *C. ambrosioides* L. | American worm sed | ganuana Khan | H(WD) | 3 |
| **CONVOLVULACEAE** | | | | |
| *Argyreia argentea* (Roxb.) Choisy | | | C(FP) | 3 |
| *A. nooken* A.Hookeri C.B. Clarke | | | C(FP) | 3 |
| *Evolvulus nummulanius* (L.) L | Water bind weed | Kami ko shag | C(WD) | 2 |
| *Ipomea aquatica* Forrsk. | | | | |
| *I cairica* (L) Sweet | | | C(FL) | 2 |
| *I camea* jacq. ssp fistulosa (Mart. ex cnoisy) Austin | | Behaya, Besnaram, Dudhiya | C(WD) | 1 |
| *I. hederifolia* L. | Star ipomoes | | C(FL) | 2 |
| *I nil* (L.) Roth | | | C(FL) | 2 |
| *I. quamoclit* L. | Rangoon Creeper | | C(FL) | 3 |
| *I turbinata* Lag. | | Gidhawar | C(FP) | 2 |
| *Merremia hederacea* (Buim F.) Hallier f. | | | C(FP) | 2 |
| *Operculina turpethum* (L.) Manaso | Indian jalap | Nisodha | C(FL,FP) | 2 |
| *Porana panaiculata* Roxb. | | Akashveli | C(FP) | 3 |
| **CORDIACEAE** | | | | |
| *Ehretia laevis* Roxb | | | T(FP) | 3 |
| **CRASSULACEAE** | | | | |
| *Kalanchoe spathulata* DC | | | H(FL) | 3 |
| **Sedum multicaule* Wall. ex Lindl. | | | H(FL) | 4 |
| **CUCURBITACEAE** | | | | |
| *Citrullus lanatus* (Thunb.) Mat & Nakai | Water melo | Tarbujo | C(FL.WD) | 3 |
| *Cucumis melo* var. agrestis Naud. | Orange melon | Ghurmi | C(FL.CW) | 3 |
| *Coccinea grandis* (L.) Voigt | Ivy gourd | Tilkor | C(FL) | 2 |
| *Diplocyclos palmatus* (L.) C. Jeffrey | | | C(FL) | 2 |
| Gymnoptalum cochichinense (Lour ) Kurz | | | C(FL FP) | 3 |
| *Momordica charantia* L | | Tite karela | C(FL CW) | 2 |
| *Mukia maderaspatana* (L) Roem. | | | C(FL) | 2 |
| *Solena amplexicaulis* (Lamk.) Gandhi | | | C(FL,FP) | 3 |
| **CUSCUTACEAE** | | | | |
| *Cuscuta reflexa* Roxb. | Dodder | Akashlati, Paheli Lahara | C(FP) | 2 |
| **ELATINACEAE** | | | | |

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|---|---|---|---|---|
| *Bergia ammannioides* Roxb. | | | | |
| | | | H(WD) | 2 |
| **EUPHORBIACEAE** | | | | |
| *Bridelia scandens* (Roxb.) Willd | | Gayo | S(FP) | 3 |
| *B sqamosa* (Lamk.) Gehrm | | Kajhı, Banangur | S(FP) | 3 |
| *Croton bonplandıanum* Baill | | Mirchaıra | H(FP) | 2 |
| *Euphorbıa heterophylla* L. | | | | |
| | | | H(FL) | 2 |
| *E hırta* L. | | Snake weed | | |
| Dudhiya | | | H(FP) | 2 |
| *E prostrata* Ait | | | | |
| Dudhiya | | | H(FP) | 2 |
| *E thymıfolıa* L. | | | | |
| | | | H(FL) | 3 |
| *Jatropa gossypifolıa* L. | Bellyache bush | Lal Bangrera | S(FL) | 3 |
| *J curcas* L. | Physıc nut | Saruva, sajıyon | S(FL) | 3 |
| *Kirganelıa reticulatus* (Poır.) Baill | | Malata | S(FL) | 2 |
| *Macaranga postulata* King ex Hook. f | | | T(FP) | 4 |
| *Mallotus phılıppensis* (Lam.) Muell-Arg. | Kamala | Roena. Sindure | T(WD.FP) | 3 |
| *Phylanthus virgatus* Frost.G. | | | H(FP) | 2 |
| *P emblica* L. | | Aura. Amla | T(FP) | 3 |
| *P urınarıa* L. | | | H(FL) | 2 |
| *Rıcinus communıs* L. | Costor seed | Ledi Aran | T(FL) | 2 |
| *Trewia nudıflora* L. | | Bhılor | T(FP) | 2 |
| **FABACEAE/LEGUMINESAE** | | | | |
| *Abrus precatorius* L | crab's eye | Leigedı, sakhıne | C(FL) | 3 |
| *Acacıa catechu* (l.f) Wıld. | cutch tree | Khair, kaha | T(FP,WD) | 2 |
| *A. nılotica* ssd. ındıca(Benth.) Brenan. | gum ardic tree | Babul | T(FL, WD) | 3 |
| *Aeschynomene ındıca* L. | | | H(FL,WD) | 2 |
| *A. aspera* l. | joint vetch | dhonaıya | H (WD) | 3 |
| *Albızıa lebbek* (L) Benth. | Black Sins, Tee-coma | Kalo Sıns | T(FP) | 3 |
| *A chınensis* (Osbeck) Merr | Tee-coma | | T(FP) | 3 |
| *Alysıcarpus vaginalis* (L.) DC. | | | H(FP FL) | 2 |
| *Alylosıa scarabaeoıdes* (L ) Benth | | | C(FP.FL) | 2 |
| *Bauhinıa purpurea* L | Pınk baunınia | Koıralo | T(FP) | 2 |
| *B vanlii* Wıgnt and Arn. | Camel's foot clımber | Malhan, Bhorla | C(FP. WD) | 3 |
| *Butea monosperma* (Lam ) Kuntze | | Palas | T(FP) | 3 |
| *Caesalpınia bonduc* (L ) Roxb. | Molucca bean | Tain.Gaınde Kosda | S(FL) | 2 |
| *Cassıa fistula* L. | Indıan laburnum | Rajbrısha, Amaltasn | T(FP) | 3 |
| *C occidentalıs* L | | Chakcr, Tapre | S(FL) | 2 |

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| *C. sophera* L. | | | S(FL) | 2 |
| *C. tora* L. | Sickle senna | Chakor, Tapre | S(FL,WD) | 2 |
| *Crotalaria alata* Buch.-Ham.ex D. Don | | Jhunihuna | H(WD) | 2 |
| *C. albida* Heyne ex Roth | | | H(FP) | 2 |
| *C. pailda* Ait. | | | H(FP) | 2 |
| *C prostrata* Rottb. ex Willd. | | Jhunjnuna | H(WD) | 2 |
| *C quinquerfolia* L. | | | H(FL) | 3 |
| *C spectabilis* Roth | | | H(FP) | 3 |
| *Dalbergia latifolia* Roth | | Satisnal | T(FP) | 3 |
| *D sissoo* Roxo ex. DC. | | Sisso | T(WD) | 3 |
| *Desmodium gangeticum* (L) DC | Tick seed | | H(FL,WD) | 2 |
| *Desmodium heterocarpon* (L) DC | | | H(FP) | 2 |
| *D laxiflorum* (Willsd) DC | | Kuro | H(FP) | 2 |
| *D triflorum* (L) DC. (D.DON) Wall ex. G | | | H(FP) | 2 |
| *Dunbana rotudifolia* (Lour) Merr | | | C(FL,FP) | 3 |
| *Erythrina subersa* Roxb. | Coral tree | | T(FP) | 3 |
| *Flemengia macrophylla* (Willd) Merr | | | S(FP) | 3 |
| *Indigofera linifolia* (L.F) Ret | | | H(FL) | 3 |
| *Lathyrus aphaca* L. | Wild pea | Jangali Kerau | H(CW) | 3 |
| *Medicago lupulina* L. | | | H(CW) | 2 |
| *Melilotus alba* Medic ex. Desr | | | H(FL) | 2 |
| *Mimosa pudica* L. | Sensitive piant | Lajaunia jnar | S(FL,WD) | 2 |
| *M rubicaulis* Lam | | Aran Boksi kands | S(FP) | 3 |
| *Mucuna pruriens* (L)DC | Cownage | kabachnua kauso | C(FL) | 3 |
| *Pithecellobium dulce* (Roxb.) Benth | Manila tamannd | Julebi | T(FL) | 3 |
| *Phyllodium pulchellum* (L) Desv | | | H(FL) | 3 |
| *Sesbania bispinosa* (Jack) W. F. Wight | | | H(FL,WD) | 3 |
| *Smithia sensitiva* Ait . | | | H(CW) | 2 |
| *Tamarindus indica* L. | Tamarinc | Imli | T(FP) | 3 |
| *Uraria lagapodioides* (L) Desv | | | H(FP) | 2 |
| *U picta* (Jacq) Desv | | | H(FP) | 3 |
| *Vicia angustifolia* L. | | Akta Misia | H(CW) | 2 |
| *V hirsuta* (L) S F Gray | | | H(FL) | 2 |
| *V tetraspermum* (L) Moench | | | H(FL) | 2 |
| **FUMAIACEAER** | | | | |
| *Fumaria indica* (Haussk.) Pugsley | Fumitory | | H(CW,WD) | 2 |
| **GENTIACEAE** | | | | |
| *Centaurium centaurioides* (Roxb.) Rao & Hamandri | | | (CW,WD) | 3 |

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| **HIPPOCRATEACEAE** | | | | |
| *Reissantia arbora* (Roxb.) Hara | | Chatpatia | S(FP) | 3 |
| **HYDROPHYLLACEAE/** | | | | |
| *Hydrolea zeylanica* (L) | | | H(CW,WD) | 2 |
| **HYPERICACEAE** | | | | |
| *Hypericum japonicum* Thunb ex. Murray | | | H(WD) | 3 |
| **LAMIACEAE (LABIATE)** | | | | |
| *Anisomeles indica* (L.) Kuntze | | Ratichorapate | H(WL) | 2 |
| *Colebrookia oppositifolia* Sm | | | | |
| Dhurselo, Goithay khar | | | S(FP FL) | 2 |
| *Hyptis suaveolens* (L.) Poit | Ban Tulasi | | H(FP,FL) | 1 |
| *Leonotis nepetaefolia* (L) Aiton | Udusmara | | H(FP) | 2 |
| *Leonurus japonicus* Houtt | Dulphe Jhar | | S(FP) | 2 |
| *Leucas indica* (L.) R. BR ex Vatke | Guma | | H(FL) | 2 |
| *L cephalotes* (Roth.) Spreng | | | H(FL) | 4 |
| *L mollissima* wall ex Benth. | | | H(FL) | 4 |
| *Mentha spicata* L. | pudina | | H(WD) | 3 |
| *Ocimum americana* L | | | H(FF) | 2 |
| *O tenuiflorum* L | Sacred basil tulasi | | H(FL,CW) | 2 |
| *Pogostemon benghalensis* (vum.f) Kuntze | | | H(FL,WD) | 2 |
| *Salvia plebei* R. Br. | | | H(FLWD) | 2 |
| **LAURACEAE** | | | | |
| *Litsea monopetala* (Roxb.) Pers. | kutmiro | | T(Fl) | 3 |
| **LENTIBULARIACEAE** | | | | |
| *Utricularia aurea* Lour | Bladderwort | | H(WD) | 2 |
| **LOBELIACEAE** | | | | |
| *Lobelia alsinoides* lank | | | H(WD) | 2 |
| **LORANTHACEAE** | | | | |
| *Dendropthoe falcata* (LF) Elting | Strap Flower Binjhi haeru | | T(FP) | 3 |
| **LYTHRACEAE** | | | | |
| *Ammannia baccifera* L | Tooth Cup Ambor | | H(WD) | 2 |
| *Lagerstroemia parviflora* Roxb. | Sidh, bote dahngreo | | H(WD) | 2 |
| *Rotala densiflora* (Roth ex R.& S) Koen | | | H(WD) | 2 |
| *R. indica* (Willd) Koen | | | H(WD) | 2 |

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| *Woodfordia fruticosa* (L.) Kurz | Durghairo, bhuidnayero | S(FP) | 3 |
| **MALVACEAE** | | | |
| *Abelmoschus manihot* (L) Medikus | simat tarul | S(FL,CW) | 2 |
| *Abutilon indicum*(L) Sweat Hochr | | S(FP,FL) | 2 |
| *Gossypium hirsutum* L. | Asiapic cottol kapas | S(FL) | 2 |
| *Sida acuta* Burm, F. | Sida banyar | H(FL) | 2 |
| *S glutinosa* Roxb | | H(FL) | 3 |
| *S rhombifolia* L. | Broom jute site banyar | H(FL) | 2 |
| *Thespesia lampus* (Cab) Dalz & Gibson | | H(FP) | 2 |
| *Urena lobata* L. | cadillo latta thulo ballu.ltunalukuro | H(FL) | 2 |
| **MELASTOMATACEAE** | | | |
| *Osbeckia nepalensis* Hook | seto chuloesi | S(FP) | 3 |
| **MELIACEAE** | | | |
| *Azadirachta indica* | margosal tree neem | T(FL) | 2 |
| *Cipadessa baccifera* (Roxb) Miq | Chamina | F(FP) | 3 |
| *Mela azedarach* L. | Persianlilsa Vakenu | T(FL) | 2 |
| **MENISPERMACEAE** | | | |
| *Cissampelos parieta* var. Hirsuta(Buch.Hal) | Gudargnu | C(FP) | 2 |
| *Stephania japonica* (Dhunb) Miers | Moolseea | C(FL, FP) | 2 |
| *Tinospora sinensis* (Lour) Merr | Gurjo | C(FP) | 2 |
| *Tiliacora acuminata* (Lamk) Miers | Rukh kane | C(FP,FL) | 3 |
| **MENYANTHACEAE** | | | |
| *Nymphoides hydrophylum* (Lour) O.Kuntze | | H(WD) | 2 |
| *N indica* (Lour) C.kuntz | | H(WD) | 2 |
| **MORACEAE** | | | |
| *Artocarpus lacucha* Buch Ham | Vadhar | T(CW) | 3 |
| *Ficus benghalensis* L | vanyan Tree Vargal bar | T(FL) | 2 |
| *F hispida* L.f. | Kothadumar | T(FL) | 2 |
| *F. hirta* Wall | | C(FL) | 4 |
| *F ovata* D. Don | | C(FL) | 4 |
| *F racemosa* L | Cluhter fig gutar, dumn | T(FP) | 3 |
| *F.religiosa* L | Vo-tree pipar tree | D(FL) | 3 |
| *F semicordata* Buch-Ham ex. Sm. | Khloayoo | T(FP,WD) | 3 |
| *F virens* ait | Khumur.pakar | T(FL) | 3 |
| *Streblus asper* Lour | javasand paperlem sihora | D(FP,WD) | 2 |

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| **MORINGACEAE** | | | |
| *Moringa oleifera* Lamk | Drum stick saninjan | D(FL) | 3 |
| **MYRTACEAE** | | | |
| *Syzygium cumini* L. Skeels | Black Blump juman | T(FP,WD) | 3 |
| **NYMPHAEACEAE** | | | |
| *Nelumbo nucifera* Gaertin | Lotus Rato Kamal | H(WD) | 2 |
| *Nymphaea nouchali* Burm.f. | Water lily Seto Kamal | H(WD) | 2 |
| **NYCTAGINACEAE** | | | |
| *Boemavia diffusa* L | Bog Weeas Punarnaawa | H(FL) | 2 |
| **OLEACEAE** | | | |
| *Nyctanthes arbor-tristis* L | Night Jasmine Harshingar, Darihja | T(FP) | 2 |
| **ONAGRACEAE** | | | |
| *Fissendocarpa linifolia* (Vahl) Belle | Loyange Janar | F(FL,WD) | 2 |
| *Ludwigia adescendens* (L) Hara | Water Pnmrosee | H(WD) | 2 |
| L. *octovalvis* (Jacq) Ravel | | H(WD) | 2 |
| *L. Perennis* L . | | H(WD) | 2 |
| **OROBANCHACEAE** | | | |
| *Orobanche aegytica* Pers | Tlokarl | H(CW) | 2 |
| **OXALIDACEAE** | | | |
| *Vlophytum sensitivum* L DC | Lajabati | H(FL) | 3 |
| *Oxalis corniculata* L. | Wood sorrel amta chan amilc | H(WD) | 2 |
| **PAPAVERACEAE** | | | |
| *Argemone mexicana* L | Lexmeica pnyckly poppy katalya plakal | H(FL, WD) | 2 |
| **PIPERACEAE** | | | |
| *Peperomia Pellucida* L Kunth | Pblainar | H(FL) | 2 |
| *Piper longum* L | Long paper Pipata | C(FP) | 3 |
| **PLANTAGINACEAE** | | | |
| *Plantago erosa* Wall | Sapghol | H(FL) | 3 |
| **PLUMBAGINACEAE** | | | |
| *Plumpbago zeylanica* L | | H(FL) | 3 |
| **POLYGALACEAE** | | | |

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|---|---|---|---|
| *Polygala avensis* Willd | | H(WD) | 2 |
| **POLYGONACEAE** | | | |
| *Polygonum barbatum* L | Joint Weed pisnar kiree | H(WD) | 2 |
| *P.hydropiper* L | Hydro Piper Joint pire | H(WD) | 2 |
| *P kawagoeanum* Makilo | | H(WD) | 4 |
| *P.glabrum* Wild | joint weed | H(WD) | 3 |
| *P. lapathifolium* L | Mirminiaia | H(WD) | 2 |
| *P plebetum* R.Br | | H(WD) | 2 |
| *Rumex dentatus* L. | | H(WD) | 2 |
| **PORTULACACEAE** | | | |
| *Portulaca oleracea* L | Common Pursliane Nymaya Ke shag | H(FL) | 2 |
| **PRIMULACEAE** | | | |
| *Anagallis arvensis* L | Blue Prmperl Armaate | H(CW,FL) | 2 |
| *Primula umbellata* (Lour) Bentv. | | H(CW.FL) | 2 |

**RANUNCULACEAE**

| | | | | |
|---|---|---|---|---|
| *Ranunculus scelratus* L. | Celery leaved crowroot | | H(WD) | 2 |
| *R aquitalis* L. | Crowfoot butter-cup | | H(WD) | 4 |
| *R diffusa* DC | Crowfoot butter-cup | | H(WD) | 4 |

**RHAMNACEAE**

| | | | | |
|---|---|---|---|---|
| *Zizyphus mauritiana* Lam. | Chinese date | Bayar | S(FL) | 2 |

**RUBIACEAE**

| | | | | |
|---|---|---|---|---|
| *Anthocephalus chinensis* (Lam.) A. Rich. Ex Walp | | Kadam | T(FL,WD) | 3 |
| *Borrena alata* (Aubt.) DC. | | | H(FP,WD) | 3 |
| *B articularis* (L f.) Will. | | | H(CW,FL) | 3 |
| *Catunaregam uliginosa* (Getz) Sivarajan | Pirar | | T(FP,WD) | 3 |
| *Dentella repens* (L) J. & G. Forst. | | | H(WD) | 2 |
| *D serpyllifolia* Wall . ex Craib | | | H(CW,WD) | 2 |
| *Hedyotis corymbosa* (L) Lm. | Mader weed | | H(CW,WD) | 2 |
| *H diffusa* Willd | | | C(FL) | 3 |
| Meyna pubescens ( Kurz) Robyns | | | S(FL ,FP) | 3 |

**RUTACEAE**

| | | | | |
|---|---|---|---|---|
| Aegle marmelos(L) Correa | Wood apple | Bet | T(FP) | 3 |
| *Murraya paniculata*(L) Jack. | Chinese myrtle | Kmini | T(FP) | 3 |

**SALICACEAE**

| | | | | |
|---|---|---|---|---|
| *Salix tetrasperma* Roxd. | | Bams | T(WD) | 3 |

**SAPINDACEAE**

| | | | | |
|---|---|---|---|---|
| *Cardiospermum halicacabum* L | Bailon vine | Jyousnati, Tilbor | C(FP) | 2 |
| *Madhuca longifolia* (Koen) Macande | lilipe cutter | | T(FL) | 4 |

**SCROPHULARICEAE**

| | | | | |
|---|---|---|---|---|
| *Bacopa monnteri* (L) pennell | Water hyssop | | H(WD)) | 3 |
| *Dopatrium junceum* (Roxo) Bucn dam.ex | | | H(WD) 3 | |
| *Limnopnila indica* (L) Druce | | | H(WD) | 2 |
| *Lindenbergia indica* (L) Varje | | | H(WD) | 3 |
| *Lindemia anagallis* (Burm.r.) Pennetl | | | H(FP WD) | 2 |
| L.antipoda (L.) Alston | | | H(CW.WD) | 2 |
| *L caliata* (Colsm.) pennell | | | H(FP.ED) | 2 |
| *L crustacea* (L.) F. Mueil. | | | H(WD) | 2 |
| *L procumbens* (Krock.) Boroas | | | H(WD) | 2 |
| *L pusilla* (Willd) Bold. | | | H(WD) | 2 |
| *L viscosa* (Hom) Bold . | | | H(WD) | 2 |
| *Mazus pumilus* (Burm.f.) Van Steenis | | | H(WD) | 2 |
| *Mecardonia procumbens* (mill.) Small | | | H(FL) | 3 |
| *Scoparia dulcis* L. | Sweetbroon sica | Mithuwa Khar | H(FP) | 2 |
| *Torenia indica* Saldanna | | | H(FL) | 3 |
| *Veronica anagallis - aquatica* L. | | Dhapre jhar | H(WD) | 2 |
| **SOLANACEAE** | | | | |
| *Datura metel* L. | Downy datura | Dhatur | S(FL) | 2 |
| *Physalis peruviana* L. | Cape goose berry | JangallMewa | H(FL,OW) | 3 |
| *P minima* L. | | Jangall Mewa | H(FL) | 3 |
| *Solanum aculeatissimum* Jacq | | Kantkan | H(FL) | 2 |
| *S anguivi* Lamk. | | | H(FL) | 3 |
| *S nigrum* L | black hide shade | Bhatkaiya.Bin | H(fl) | 2 |
| *S surrattense* Burm.f. | indian Salamon | Rengan Kantaka | H(FL) | 2 |
| *S . torvum* Swartz | jerselem cherry | Banbhanta kecherra | S(FL) | 3 |
| **SPHENOCLEACEAE** | | | | |
| *sphenoclea zeylanica* Gaerth | goose weed | panimach | h(wd) | 2 |
| **STERCULIACEAE** | | | | |
| *Melochia corchorifolia* | wild mallow | patuwajhar | h(FL) | 2 |
| **TAMARICACEAE** | | | | |
| *Tamarix dioica* Roxb | | jnauwa | S(wd) | 2 |
| **TILIACEAE** | | | | |
| *Corchorus aestuans* L. | | jangali patuwainar | H(fl) | 2 |
| *Grewia disperma* Rotto | | pnorsa sivai dnusre | T(fp) | 3 |
| *G oppositifolia* Buchham ex. Roxb | | | t(fl) | 4 |
| *G. optiva* J.R.Drumm ex. Burre | | | T(fl) | 4 |

| | | | | |
|---|---|---|---|---|
| *Triumfetta momboides* Jacq. | burweed | | H(fl) | 2 |
| **TRAPACEAE** | | | | |
| *Trapa bispinosa* Roxb | water chestnut | Singra | H(wd) | 3 |
| **ULMACEAE** | | | | |
| *Trema orientalis* (L ) B. | cnaoe tree | knan kuve | T(fl) | 3 |
| **UTRICACEAE** | | | | |
| *Boehmeria platyphylla* D.Don | china grass | Gargaic | H(WD:FL) | 3 |
| *Gonostegia oppositifolia* | | | H(FL) | 4 |
| *Pauzolzia pentandra* Benn | | | H(FL) | 3 |
| *P Zeylanica* (L.) Benn | | Maaslanare | H(WD) | 2 |
| **VERBENACEAE** | | | | |
| *Callicarpa arborea* Roxb | | Guyalo | S(FL) | 3 |
| *C. macrophylla* Vahl | | budniyadai Ke Lawa | S(FL) | 3 |
| *Clerodendrum indicum* (L) Kuntz | | Babhnaithi | H(FL,FP) | 3 |
| *C. viscosum* Vent | Turks turbam | Bnat | H(FL,FP) | 3 |
| *Duranta repens* L. | malay Dush -beech | knamar | T(FP) | 2 |
| *Gmelina arborea* Roxb. | nakaybysh -beech | knamar | S(fL) | 2 |
| *Lantana camera* L. | | phulajnar | s(FL) | 2 |
| *Phyla nodiflora* (L.) Green | Toao stool | kurkure jhar | H(FL,WD) | 2 |
| *Vitex negundo* L. | indian pnvet | senuwan,simall | T(FP) | 2 |
| **VITACEAE** | | | | |
| *Ampelocissus latifolia* (Roxb.) Planch | | | C(FP) | 3 |
| *Cayratia trifolia* (L.) Domin | Trifoiiate grape | panlati, Karauja | C(FP,WD) | 2 |
| *Cissus javanica* DC | | panlati, Karauja | C(WD) | 3 |
| *Tetrastigma serrulatum* (Roxb.) Planch. | Pani lahara | | C(WD) | 3 |
| **ANGIOSPERMS-MONOCOTS** | | | | |
| **ALISMATACEAE** | | | | |
| *sagittaria guayanensis* ssp. lappula (D.Don) Bogin | | | H(WD) | 2 |
| *S. trifolia* L. | Arrow-head | | H(WD) | 2 |
| **APONOGETONACEAE** | | | | |
| *Aponogeton natans* Engl. Krause | | | H(WD) | 3 |
| **ARACEAE** | | | | |
| *Acorus calamus* L | Sweet flag | Bojha | H(wd) | 3 |

| | | | | |
|---|---|---|---|---|
| *Alocasia macrorrhiza* Schot | Giant taro | Ghyamphe tarul | H(wd) | 3 |
| *Amorphohallus bulbifer* (Schott) | | Oal | H(fl) | 3 |
| *Arisaema tortuosum* (Wall). Schott | | Sarpa ko makai | H(FP) | 3 |
| *Colocasia esculenta* (L) Schott | Co-Co_yam | Ankonch. Karkalo | H(WD) | 2 |
| *Lassia spinosa* (L) Thwaites | | | H (WD) | 3 |
| *Pistia stratiotes* (L.) | Water lettuce | jal kobhi | H(WD) | 2 |
| **ARECACEAE (PALMAE)** | | | | |
| *Phoenix sylvestris* Roxb. | | Khajur | T(FP) | 3 |
| **BUTOMACEAE** | | | | |
| *Butomopsis latifolia* (D.Don) Kunth | | | H(WS) | 3 |
| **COMMELINACEAE** | | | | |
| *Commelina benghalensis* L. | Day flower | Kane saag | H(WD) | 2 |
| *Commelina paludosa* Blume | | | H(WD) | 2 |
| *Cyanotis cristata* (L) D.Don | | | H(WD) | 2 |
| *Floscopa scandens* Lour | Simkane Ghams | | H(WD) | 2 |
| *Murdannia nudiflora(L) Brenam* | | | H*(WD)* | *2* |
| *Tonningia axilaris* (L) Kuntz | | | H(WD) | 2 |
| **CYPERACEAE** | | | | |
| *Buibostylis barbata* (Rotth.)Cl. | | | H(WD) | 3 |
| *Cyperus compactrus* Rtz. | | | H(WD) | 2 |
| *C compressus* L. | Sedge | Motha | H(WD) | 3 |
| *C corymbosus* Rotth. | Sedge | Motha | H(WD) | 2 |
| *C difformis* L. | Sedge | Mkotha | H(WD) | 1 |
| *C diffusus* vahl. | Sedge | Motha | H(WD) | 2 |
| *C. digitatus* Roxb. | Sedge | Motha | H(WD) | 3 |
| *C distans* L.f. | Sedge | Motha | H(WD) | 2 |
| *C esculentus* L. | Sedge | Mothaa | H(WD) | 4 |
| *C exaltatus* Retz | Sedge | Motha | H(WD) | 3 |
| *C halpan* L. | Sedge | Motha | H(WD) | 2 |
| *C iria* L. | Sedge | Motha | H(WD) | 2 |
| *C platystylis* R.Br. | Sedge | Motha | H(WD) | 3 |
| *C procerus* Rotth. | Sedge | Motha | H(WD) | 2 |
| *C rotundus* | Sedge | Motha | H(WD) | 2 |
| ***Elaeochans dulcis*** Burm.f. Trin.ex Henscnel | Sedge | Motha | H(WD) | 2 |
| *E acutangula* (Roxb.) Schuif. | Sedge | Motha | H('WD) | 3 |
| *E atropurpurea* (Retz.) Kunth | | | H(WD) | 2 |
| *Fimbristylis dichotoma* (L.) Vahl | | | H(WD) | 2 |
| *F. aestivalis* (Retz) vahi | Matrush | Motha | H(WD) | 2 |

| | | | | |
|---|---|---|---|---|
| *F. littoraiis* Gand. | | | H(WD) | 2 |
| *F. miliacea* (L.)vahi | Matrush | Motha | H(wD) | 2 |
| *F schoenoides* (Retz.) vahı | Matrush | Motha | H(WD) | 2 |
| *Fuırena ciliaaaaaris* (L.) Roxb. | Matrush | Motha | H(WD) | 2 |
| *Kyilinga brevıfolia* Rottb. | | | H(WD) | 2 |
| *K. nemoralıs* (J.R.& G.Forster ) Dandy ex | | | H(WD) | 2 |
| *Pycreus flavidus* (Retaz) Koyaama | Sedge | Motha | H(WD) | 2 |
| *P pumilus* (L.) Nees ex Cl. | | | H(WD) | 2 |
| *P sanguinolentus* (Vahl) | | | H(WD) | 2 |
| *Schoenoplectus artıculatus* Palla | Bulrusn | | H(WD) | 2 |
| *S juncoıdes* (Roxb.) | Bulrusn | | H(WD) | 2 |
| *S grossus* (L.f.) Palla | Bulrusn | Kaysoor | H(WD) | 2 |
| *S lateriflorus* (Gmel.)Lye | Bulrusn | | H(WD) | 2 |
| *S mucronatus* (L.) Palla | Bulrusn | | H(WD) | 2 |
| **DLOSCOREACEAE** | | | | |
| *Dioscorea bulbifera* L | Potato yam | Gittha.panglung | C(WD) | 3 |
| *D pentaphylla* L | parmate leaved yam | | C(fP) | 3 |
| **ERIOCAULACEAAE** | | | | |
| *Enocaulon cinereum* E. Br | | | H(wD) | 2 |
| **HYDROCHARITACEAE** | | | | |
| *Hydrılıa vertıcıllata* (L.f) Royle | Hydrilla | | H(WD) | 2 |
| *Hydrocharis dubia* Backer | | | H(WD) | 2 |
| *Ottelıa alismoıdes* (L) Pers | | | H(WD) | 2 |
| *Vallısnerıa spiralıs* L | | | H(WD) | 2 |
| **HYPOXIDACEAE** | | | | |
| *Curculıgo orchıoıdes* Gaertn | Biack musale | Musal | H(FP) | 3 |
| **JUNCACEAE** | | | | |
| *Juncus bufonıus* L. | | | H(WD) | 3 |
| **OLIACEAE** | | | | |
| *Asparagus racemosus* Wıld | wild asparagus | Santawar Kumo | S(FP) | 3 |
| *Chlorophytum arundinaceum* Baker | | | H(FP) | 3 |
| *Wolfia globosa* (Roxb) Hartog &Plas | | | H(WD) | 2 |
| **ORCHIDACEAE** | | | | |
| *Spiranthes sınensis* Wıld | wild asparagus | Santawar Kumo | H(FP) | 3 |
| *Zeuxine strateumatıca* (L) Senıechter | | | H(WD) | 3 |

**POACEAE (GRAMINEAE)**

| | | | | |
|---|---|---|---|---|
| *Apluda mutica* | dakle Knr | | (FLWD) | 2 |
| *Arundo donax* L | knr | | h(wd) | 2 |
| *Axonopus compressus* (SW)P Beauv | | | H(FLWD) | 2 |
| *Bothriochloa bladhii* (Retz) Blake | | | H(FLWD) | 2 |
| *Brachiaria distachya* (L) Stapf | | Signal grass | H(WD) | 2 |
| *B ramosa* (L) Stapf | Signal grass | | H(FKWD) | 2 |
| *B reptans* (L) Garan.& Hubb | | | H( WD) | 2 |
| *Carex microglochin* Wahlenb | | | H( WD) | 2 |
| *Chrysopogon aciculatus* | | | H( WD) | 2 |
| *Cymbopogon jwarancusa* (Jones) Schulto | Khar | | H( WD) | 2 |
| *C Martinii* (Roxb) W. Wastson | | | H(WD) | 2 |
| *C Pendulus* (Nees ex Steud) Wort | | Khar | H(WD) | 2 |
| *Cynodon arcuatus* J. & C. presl | | Dubo | H(GL.WD) | 2 |
| *C dactylon* (L) Pers. | Bermuaa grass | Dubo | H(FLWD) | 2 |
| *Cyrtococcum accrescens* (Trin) Stapf | | | H( FL) | 2 |
| *Dactyloctenium aegypticum* (L) Beauvois | Crowfoot grass | | H(FL.WD) | 2 |
| *Desmostachya bipinnata* (L) Stapf | Kush grass | Kush | H(FL.WD) | 2 |
| *Dichanthium annulatum* (Roemer &Schuites) | | | *H(FL)* | *2* |
| *Digitaria abludens* (Roemer &Schuites) Veldkamp | Banso | | H(GL.WD) | 2 |
| *D ciliaris* (Retz) Koeler | | Banso | H(GL.WD) | 2 |
| *D setigera* Roth ex R&S | | Banso | H(GL.WD) | 2 |
| *D. violascens* Link | | Banso | H(CL.WD) | 2 |
| *Echinochola colona* (L) Link | Bamyard grass | Sama | H(GL.WD) | 3 |
| *E.crusgalli* (L) P. Beav | Bamyard grass | sama | H(GL.WD) | 2 |
| *E cruspavonis* (H.B&K) Schult | Bnstiy sama | | H(CL.WD) | 2 |
| *Eleusine indica* (L) Gaertn | Goose grass | Kodejhar | H(FL.WD) | 2 |
| *Elytrophorus spicatus* (Wild) A.Camus | | | H(WD) | 3 |
| *Eragrostis atrovirens* (Desf) Trin ex Steud | | Banso | H(FL.WD) | 3 |
| *E.gangetica(Roxb)* Steud. | | Banso | H(FL) | 3 |
| *Eragrostis coarctata* Stapf | | Banso | H(GL.WD) | 2 |
| *E.japonica* (Thunb) Trin | | Banso | H(FL) | 2 |
| *E tenella* (L)P Beauv.ex R&S | | Banso | H(GL WD) | 2 |
| *E unioloides* (Retz)Nees ex Steudel | | Banso | H(GL.WD) | 2 |
| *Eriochloa procera* (Retz)Hubb. | | | H(WD) | 2 |
| *Eulaliopsis binata* (Retz)C.E.Hubbard | Saba,Babiyo | | H(WD) | 3 |
| *Erianthus ravennae* (L).Beauvois | | | H(WD) | 3 |
| *Hemarthria compressa* (L.F)R.Br | | | H(WD) | 2 |
| **Hygrorhyza aristata* (Retz)Nees ex W.&A. | Wild rice | Ghans | H(WD) | 3 |
| *Hymenachne pseudointerrupta* C.Muell. | | | H(WD) | 3 |

| | | | | |
|---|---|---|---|---|
| *Imperata cylindrica* (L)Beuvois | | Siroo | H(GL,WD) | 2 |
| *Isachne globosa* (Thunb) O.Kuntze | | | H(WD) | 3 |
| *Ischaemum rugosum* Salisb | | | H(WD) | 3 |
| *Leersia hexandra* Sw. | Wild rice | Navo dhan | H(WD) | 3 |
| *Leptochloa chinensis* (L.) Nees | | | H(WD) | 3 |
| *Oplismenus burmannii* (Retz.) Beauvois | | | H(WD) | 2 |
| *O compositus* (L.) P. Beauv. | | | H(WD) | 3 |
| *Oryza rufipogon* Griff. | Wild rice | Jangali dhan | H(WD) | 3 |
| *Panicum paludosum* Roxb | | Urila | H(GL,WD) | 2 |
| *Paspalidium flavidum* (Retz.) A. Camus. | | | H(GL,WD) | 2 |
| *P punctatum* (Burm f.) A. Camus | | | H(WD) | 2 |
| *Paspalum distichum* L. | Wild Dalis grass | | H(WD) | 2 |
| *P conjugatum* Bergius | | | H(WD) | 2 |
| *P scrobiculiatum* L. | Wild mittlet | | H(WD) | 2 |
| *Phalaris minor* Retz. | | | H(WD) | 3 |
| *Phragmites karka* (Retz.) Trin. ex Steudel | Common reed grass | Narkat | H(FL,WD) | 1 |
| *Pogonatherum crinitum* (Thunb.) Kunth | | | H(FL,WD) | 2 |
| *P. monspeliensis* (L.) desf. | | | H(WD) | 2 |
| *Saccharum spontaneum* L. | Tharcn grassKans | | H(FL,WD) | 1 |
| *Sacciolepis indica* (L.)A Chase | | | H(WD) | 2 |
| *Setaria glauca* (L.) Beauvois | | | H(FL,WD) | 2 |
| *S pumila* (Poir.) R&S. | Kavatta grassKanike kaguno | | H(GL,Wd) | 2 |
| *S tomentosa* (Roxo.)Kunth | Ghoae-canso | | H(WD)( | 2 |
| *Sporobolus indicus* var.diander Jov.(Retz.) &Gued | vicıasn grass khude grass | | H(GL,WD) | 2 |
| *Thysanoiaena maxima* (Roxb.)Kuntze | bouquet grass | Amriso. kucno | H(WD) | 3 |
| *Vetivera zizanioides* (L.) | Vetiver grass | Khus Khus | H(WD) | 2 |
| **PONTEDERIACEAE** | | | | |
| *Eichhornia crassipes* (Mart.) Solms | Water hyacinth | jalkumni | H(WD) | 1 |
| *Monochoria hastata* (L.) Slom. | | | H(WD) | 2 |
| *Monochoria vaginalis* (Burm f.) C. presl | | | H(WD) | 2 |
| **POTAMOGETONACEAE** | | | | |
| *Potamogeton crisous* L. | | | H(WD) | 2 |
| *P lucens* L | | | H(WD) | 4 |
| *P nodosus* Poir. | | | H(WD) | 4 |
| *P pectinatus* L. | | | H(WD) | 4 |
| **TYPHACEAE** | | | | |
| *Typha elephantina* Roxb. | Cat-tail | Pater | H(WD) | 1 |

*Source IUCN field study*

**Sah, 1997, Koshi Tappu Wet Lands*

*Hari Thapaliya, 1999- 2001.*

| | | | | |
|---|---|---|---|---|
| **NOTE** Habit: | H=Herb· | S=Shrub: | T=Tree | C=Climber |
| Habitat | CL=Cropland· | FL=Fallow land | FP=Forest plant | |
| | GL=Grassland: | WL=Wetland | | |

*Status scale based on visual rating*

| | | | |
|---|---|---|---|
| 1=Abundant | 2=Common | 3=Occasional | 4=Rare |

# APPENDIX –5

## Koshi tappu wildlife Reserve
## Mammals Checklist

| S.No | Family | Common Name | Scientific Name | A | B | C | D |
|---|---|---|---|---|---|---|---|
| 1 | Pteropodidae | Indian flying Fox | *Pteropus giganteus* | | | | |
| 2 | Vespertilionidae | Indian Pipistrelle | *Pipistrelius coromandra* | | | | |
| 3 | cercopithecidae | Rnesus Macaque | *Macaca mulatta* | s | | 2 | |
| 4 | | Hanuman Langur | *Semnopithecus entelius* | s | | 1 | |
| 5 | Canidae | Golden Jackel | *Canis aureus* | | | | |
| 6 | | Bengal Fox | *Vuipes benghalensis* | s | | 3 (in) | |
| 7 | Mustelidae | Yellow throated Marten | *Martes flaviguia* | | | | |
| 8 | Lutranae | common otter | *Lutra lutra* | s | | 1\ | |
| 9 | | smooth coated otter | *Lutrogate perspicillate* | s | k | 2 | |
| 10 | viverridae | Large India civet | *viverra zibetna* | | | | |
| 11 | | small india civet(Rasse) | *viverricula indica* | | | | |
| 12 | Herpestidae | India grey Mongoose | *Herpestes edwardsil* | | | | |
| 13 | | small Asian Mongooes | *Herpestes javanicus* | | | | |
| 14 | Felidae | Jungle Cat : | *Felic chaus* | s | | 2 | |
| 15 | | Fishing Cat: | *pnonaliurus viverrinus* | v | k | 2 | |
| 16 | | spotted Leopard | *Panthera pardus* | s | | 1 | |
| 17 | Platanistidae | Gangetic Dolphin | *Patanista gangetica* | 0 | v | 1 | |
| 18 | Elephantidae | Asiatic Elephant | *Elephas maximus* | E | E | 1 | |
| 19 | Suidae | wild Boar | *Sus scrofa* | | | | |
| 20 | Cervidae | spotted Deer | *Axis axis* | | | | |
| 21 | | Hog Deer | *Axis porcinus* | s | | 1 | |
| 22 | | Barking Deer | *Muntiacus muntijak* | | | | |
| 23 | Bovidage | Indian Bison | *Bos gaurus* | E | v | 1 | |
| 24 | | Wild Water Buffalo | *Bubalus arnee* | c | E | 3(NP) | |
| 25 | | Blue Bull Antelope | *Boselaphus* | v | | | |
| 26 | | | *tragocamelus* | | | | |
| 27 | Sciuridae | Black Glant Squirrel | *Ratufa bicolor* | | | | |
| 28 | | Three striped squirrel | *Funambulus palmarum* | | | | |
| 29 | | Five striped Squirrel | *Funambulus pennati* | | | | |
| 30 | Pteromyidae | Red flying squirrel | *Petaurista petaurista* | | | | |
| 31 | Hystricidae | India Crested Porcupine | *Hystrix indica* | | | | |
| 32 | Leporidae | India Hare | *Lepus nigricollis* | | | | |

Column A=National Red Data List 1995; Column B=IUCN Red Data List 1994'

Column C=CITES List 1994; Column D=Check and remarks

Legend: = HMG protected; C=Critically endangered; E = Endangered S=Susceptible V= Vulnerable I= Indeterminate; K=Insufficiently Known; IN= India: I= Appendix; 2=AppendixII

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Source: IUCN, Hari Thapaliya 1999-2001

# APPENDIX –6

## Koshi tappu wildlife Reserve
## Bird checklist

| Order//family/English name | Scientificname | status | References | |
|---|---|---|---|---|
| **GALLIFORMES** | | | | |
| Phasianidae | | | | |
| Black Francolin | *Francolinus francolinus* | br,1 | 1 | |
| Grey Francolin | *Francolinus pondicerianus* | | r? | 28 |
| Swampfrancolin | **Francolinus gularis* | br, 1 | 1 | |
| Common Quail | *Coturnix coturnix* | m?,3 | 1 | |
| Blue-breasted Quail | *Coturnix chinensis* | m,3 | 1 | |
| Red Junglefowl | *Gallus gallus* | br,4 | 1 | |
| Indian Peafowl | *pavo cristatus* | br,4 | 1 | |
| **ANSERIFORMES** | | | | |
| Dendrocygnidae | | | | |
| Fulvous Whistling Duck | *Dendrocygna bicolor* | M, 5 | 27, 33 | |
| Lesser Whistling Duck | *Dendrocygna javanica* | | | |
| **Anatidae** | | | | |
| Greylag Goose | *Anser anser* | m,4 | 1 | |
| Bar-HeadedGoose | *Anserindicus* | m,3 | 1 | |
| Ruddy-Shelduck | *Tadorna ferruginea* | w, 1 | 1 | |
| Common Shelduck | *Tadorna tadorna* | w,5 | 33 | |
| Comb duck | *Sarkidiornis melanotos* | s, 3 | 33 | |
| Cotton Ptgmy-goose | *Neettapus coromandelianus* | r, s, 3 | 1 | |
| Gadwall | *Anas strepera* | w, 1 | 1 | |
| Falcated Duck | *Anas falcata* | w, 3 | 1 | |
| Eurasian Wigeon | *Anas penelope* | w,2 | 1 | |
| Mallard | *Anas platyrhynchos* | w, 1 | 1 | |
| Spot-billed Duck | *Anas poecilorhyncha* | r, w, 1 | 1 | |
| Northern Shoveler | *Anasw clypeata* | w, 2 | 1 | |
| Northern Pintail | *Anas acuta* | w, 1 | 1 | |
| Garfaney | *Anas querquedula* | w,1 | 1 | |
| Baikal Teal | *Anas formosa* | # v | 33 | |
| Common Teal | *Anas crecca* | w, 1 | 1 | |
| Red-crested Pochard | *Rhodnessa rufina* | w, 2 | 1 | |

| | | | |
|---|---|---|---|
| Common Pochard | *Aythya ferina* | w, 1 | 1 |
| Ferruginous Pochard | *Aythya nyroca* | w, 1 | 1 |
| Baer's Pochard | **Aythya baeri* | w, 3 | 1 |
| Tufted Duck | *Aytha fuligula* | w, 1 | 1 |
| Greater Scaup | *Aythya marila* | # *v* | *33* |
| Long -tailed duck | *Clangula hyemalis* | # *v* | *33* |
| Common Goldeneye | Bucephala *clangula* | v | 40 |
| Smew | *Mergellus albelluss* | *v* | *25* |
| *Red - breasted* | *Mergus serrator* | # *v* | *33* |
| *Common Merganser* | *Mergus merganser* | *w, 4* | *1* |

**TURNICIFORMES**

*Turnicidae*

| | | | |
|---|---|---|---|
| *Yellow-legged Buttonquail* | *Turnix tanki* | *r,3* | *1* |
| *Barred Buttonquail* | *Turnix* | | |

**PICIFORMS**

Picidae

| | | | |
|---|---|---|---|
| Eurasian Wryneck | *Jynx torquilla* | w,m,3 | 1 |
| Brown- capped | *Dendsrocopos nanus* | s?5 | 28 |
| Grey- capped Pygmy Woodpecker | *Dendrocopos canicapillus* | r?4 | 1 |
| Fulvous-breasted Woodpecker | *Dendrocopos macei* | br,1 | 1 |
| Rufous Woodpecker | *Celeus brachyurus* | r,3 | 1 |
| Sterk-throadted Woodpecker | *picus xanthophygaeus* | r,3 | 1 |
| Grey-headed Woodpecker | *picus canus* | r,3 | 1 |
| Black-rumped flameback | *Dinopium benghalensis* | br,1 | 1 |

**MEGALAIMIDE**

| | | | |
|---|---|---|---|
| Lineted Barbet | *Megalaima lineata* | br,3 | 13 |
| Blue -throated Barbet | *Megalaima asiatica* | br,2 | 1 |
| Coppersmith barbet | *Megalaima haemacephala* | br,1 | 1 |

**BUCEROTIFORMES**

Bucerotidae

| | | | |
|---|---|---|---|
| Indian Grey Hornbill | *Ocyceros birostris* | r,3 | 38 |

**UPUPIFORMES**

Upupidae

| | | | |
|---|---|---|---|
| Common Hoopoe | *Upupa epops* | s,w,m | 11 |

| | | | |
|---|---|---|---|
| **CORACIIFORMES** | | | |
| Coraciidae | | | |
| Indian Roller | *Coracias benghalensis* | br, 1 | 1 |
| Dollarbird | *Eurystomus orientalis* | s, 3 | 10 |
| **ALCEDINIDAE** | | | |
| Common Kingfisher | *Alcedo atthis* | br, 1 | 1 |
| **DACELONIDAE** | | | |
| Stroke-billed Kingfisher | *Pelargopsis capensis* | br,1 | 1 |
| White-throated Kingfisher | *Halcyon smyrnesis* | br,1 | 1 |
| Black-capped Kingfisher | *Halcyon pileata* | m,4 | 36 |
| **CERYLIDAE** | | | |
| Pied kingfisher | *Ceryle rudis* | br,1 | 1 |
| **MEROPIDAE** | | | |
| blue-beared bee-eater | *Nyctyornis athertoni* | r?,3 | 21 |
| green bee- eater | *Merops orientalis* | br,1 | 1 |
| blue tailed Bee eater | *Merops philippinus* | s,br,1 | 1 |
| Chestnut-headed Bee-eater | *Merops leschenaulti* | s,br,2 | 1 |
| **CUCULIFORMES** | | | |
| Cuculidae | | | |
| Pied Cuckoo | *Clamator jacobinus* | s,br,4 | 1 |
| Chestnut-winged Cuckoo | *Clamator coromandus* | s,br,5 | 11 |
| Common Hawk Cuckoo | *Hierococcyx varius* | br,2 | 1 |
| Hodgson's Hwak Cuckoo | *Hierococcyx fugax* | v | 31 |
| Indian Cuckoo | *Cuculus micropterus* | s, br, 1 | 1 |
| Eurasian cuckoo | *cuculus canorus* | s,3 | 1 |
| Oriential Cuckoo | *cuculus saturatus* | m,5 | 1 |
| Grey-bellied Cuckoo | *cacomantis passerinus* | s,4 | 1 |
| Plaintive Cuckoo | *cacomantis merulinus* | s,5 | 37 |
| Drongo Cuckoo | *Surniculus lugubris* | s,5 | 1,44 |
| Asian Koel | *Eudynamys scolopacea* | r,s,br,1 | 1 |
| Green-billed | *phaenicophaeus tristis* | r,4 | 13 |
| Sirkeer malkoha | *Phaenicophaeus leschenaultii* | br,3 | 9 |
| Centropodidae | | | |
| Greater Coucal | *Centropus sinensis* | br,1 | |

| | | | | |
|---|---|---|---|---|
| Lesser Coucal | *Centropus benghalensis* | r,s,br,2 | 1 | |
| **PSITTASCIFORMES** | | | | |
| Psittscidae | | | | |
| Alexandrine Parakeet | *Psittacula eupatria* | br,3 | 1 | |
| rose-ringed Parakeet | *Pisittacula krameri* | br,1 | 1 | |
| Slaty- headed Parakeet | *Psittacula himalayana* | w,5 | 10 | |
| Plum-headed Parakeet | *Psittacula cyanocephala* | br,1 | 1 | |
| Bossom-headed Parakeet | *Pisittacula roseata* | r?,5 | 26 | |
| Red-breasted Parakeet | *Pissttacula alexandri* | r,4 | 21 | |
| **APODIFORMES** | | | | |
| Apodiatae | | | | |
| Himalayan Swiftlet | *Collocalia brevirostris* | W,3 | 13,21 | |
| Asian Palm-Swift | *Cypsiurus balasiensis* | r,3 | 43 | |
| *Alpine* Swift | *Tachymarptis melba* | w,3 | 21 | |
| Fork-tailed Swift | *Apus pacificus* | # | W,5 | 33 |
| House Swift | *Apus affinis* | w,3 | 1 | |
| **HEMIPOROCNIDAE** | | | | |
| Creasted Treeswift | *Hemiprocne coronata* | r,4 | 1 | |
| **STRIGIFORMES** | | | | |
| Strigidae | | | | |
| Collared Scops Owl | *Otus bakkamoena* | br, 1 | 13,21 | |
| *Duskey* Eagle Owl | *Bubo coromandus* | r,5 | 1 | |
| Brown Fish Owl | *Ketupa zeylonesis* | r,2 | 1 | |
| Jungle Owlet | *Glaucidum radiatum* | br,2 | 1 | |
| Spotted Owlet | *Athene brama* | br,1 | 1 | |
| Brown Hwak Owl | *Ninox scutulata* | r,2 | 1 | |
| Short-eared Owl | *Asio flammeus* | w?,3 | 2 | |

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|---|---|---|---|
| **CAPRIMULGIDAE** | | | |
| Large-tailed Nightjar | *Caprimulgus macrurus* | r,2 | 1 |
| Indian Nightjar | *Caprimulgus asiaticus* | s,3 | 1 |
| Savana Nightjar | *Caprimulgus affinis* | s,3 | 6 |
| **COLUMBIFORMES** | | | |
| Columbidae | | | |
| Rock Pigeon | *Columba livia* | br,4 | 1 |
| Oreintial turtle Dove | *Streptopelia oreintalis* | w,2 | 1 |
| Laughing Dove | *Streptopelia senegalensis* | r?,m,4 | 13 |
| Spotted Dove | *Streptopelia chinensis* | br,1 | 1 |
| Red Collared Dove | *Streptopelia tranquebarica* | br,2 | 1 |
| Eurasisn Collared Dove | *Streptopelia decaocto* | br,1 | 1 |
| Emerald Dove | *Chalcophaps indica* | br,2 | 1 |
| Orange-breasted Green Dove | *Terron bicincta* | br,2 | 1,9,19 |
| Pompadour Green Dove | *Terron pompadora* | r,3 | 1 |
| Thick-billed Green Dove | *Terron curvirostra* | r?,5 | 29 |
| Yellow fotted Green Dove | *Terron phoenicoptera* | br,2 | 1,9,19 |
| **GRUIFORMES** | | | |
| Otiditae | | | |
| Bengal florican | **Houbaropsis benghalensis* | s,4 | 1,38 |
| Lesser Florican | ** Sypheotides indica* | s,5 | 15 |
| **GRUIDAE** | | | |
| Demoiselle Crane | *Grus virgo* | m,3 | 11 |
| Common crane | *Grus grus* | m,3 | 37 |
| **RALLIDAE** | | | |
| Water Rail | *Rallus aquaticus* | w,3 | 4 |
| Brown Crake | *Amaurornis akool* | br,3 | 1 |
| White-breasted Waterhen | *Amaurornis phenicurus* | br,1 | 1 |
| Baillon's Crake | *Porzana pusilla* | w,3 | 4 |
| Ruddy-brested Crake | *Porzana fusca* | br,1 | 17 |
| Spotted Crake | *Porzana porzana* | v | 14 |
| Watercock | *Gallicrex cinerea* | s,br,3 | 1 |
| Purple swamphen | *Porphyrio porphyrio* | br,w,2 | 1 |
| Common Moorhen | *Gallinula chloropus* | w,I | 1 |
| COmmon coot | *Fulica atra* | w,1 | 17 |
| **CICONIIFORMES** | | | |
| Scolopacidade | | | |

| | | | |
|---|---|---|---|
| Pintail Snipe | *Gallinago stenura* | w,1 | 1 |
| Common Snipe | *Gaillinago gallinago* | w,2 | 1 |
| Black-tailed Godwit | *Limosa limosa* | m,3, | 38 |
| Whimbrel | *Numenius phaeopus* | m,3 | 22 |
| Eurasian Curlew | *Numenius arquata* | w,2 | 1 |
| Spotted Redshank | *Tringa erythropus* | w,4 | 1 |
| Common Redshank | *Tringa totanus* | w,2 | 1 |
| Marsh sandpider | *tringa stagnatilis* | m,2 | 1 |
| Common Greenshank | *Tringa nebularia* | w,1 | 1 |
| Green Sandpiper | *Tringa ochropus* | w,1 | 1 |
| Wood Sandpider | *Tringa gareola* | w,1 | 1 |
| Treek Sandpider | *Xenus cinereus* | m,5 | 8 |
| Common Sandpider | *Actitis hypoleucos* | w,1 | 1 |
| Red Knot | *Calidris canutus* | m,5 | 16 |
| Sanderiling | *Calidris alba* | m,4 | 21,38 |
| Little Stint | *Calidris minuta* | w,2 | 1 |
| Temmminick's Stint | *Calidris temminckii* | w,1 | 1 |
| Dunlin | *Calidris alpina* | w,3 | 13,21 |
| Curlew Sandpider | *Calidris ferruginea* | m,4 | 33 |
| Ruff | *Philomachus pugnax* | m,3 | 13 |
| **ROSTRATULIDAE** | | | |
| Greater painted0-snipe | *Rostratula benghalensis* | br,2 | 43 |
| **JACANIDAE** | | | |
| Pheasant-tailed Jacena | *Hydrophasianus chirurgus* | r,3 | 1 |
| Bronze-Winged Jacana | *Metopidius indicus* | br,1 | 1 |
| **BURHINIDAE** | | | |
| Eurasian Thick-Knee | *Burhinus oedicnemus* | r,2 | 1 |
| Great Thick-Knee | *Burhinus recurvirostris* | r,2 | 1 |
| **CHARADRIIDAE** | | | |
| Black Winged Stilt | *Himantopus himantopus* | m,3 | 1 |
| Pied Avocer | *Recurvirostra avosetta* | m,4 | 1 |
| Pacific Golden Plover | *Pluvialis fulva* | m,3 | 1 |
| Grey Plover | *Pluvialis squatarola* | # m,3 | 33 |
| Little Ringed Plover | *Charadrius dubius* | br,1 | 1 |
| Kentish Plover | *Charadrius alexandrinus* | w,2 | 1 |
| Lesser Sand Plover | *Charadrius mongolus* | m,4 | 3,38 |
| Greater Sand Plover | *Charadrius leschenaultii* | m,4 | 3 |
| Northern Lapwing | *Vanellus vanellus* | w,3 | 8,43 |

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|---|---|---|---|
| Yellow-wattled Lapwing | *Vanellus malarbaricus* | r?,w,3 | 1 |
| River Lapwing | *Vanellus duvaucelii* | br,3 | 1 |
| Grey-headed Lapwing | *Vanellus cinereus* | w,2 | 21 |
| Red-wattled Lapwing | *Vanellus indicus* | br,1 | 1 |
| **GLAREOLIDAE** | | | |
| Indian Courser | *Cursorius coromandelicus* | r?,br,4 | 1,11 |
| Oriental Pratincole | *Glareola maldivarum* | s,4 | 36 |
| Small Pratincole | *Glareola lactea* | br,1 | 1 |
| **LARIDAE** | | | |
| Indian Skimmer | **Rynchops albicollis* | s,4 | 22 |
| Mew Gull | *Larus canus* | #m,5 | 33,36 |
| Yellow-legged Gull | *Larus cachinnans* | m,3 | 44 |
| Heuglin's Gull | *Larus heuglini* | #m,5 | 33 |
| Pallas's Gull | *Larus ichthyaetus* | w,2 | 17 |
| Brown-headed Gull | *Larus brunnicephalus* | w,3 | 1 |
| Black-headed Gull | *Larus ridibundus* | w,3 | 17 |
| Slender-billed Gull | *Larus genei* | #w,4 | 33 |
| Gull-billed Tern | *Gelochelidon nilotica* | w,3 | 13 |
| Caspian Tern | *Sterna caspia* | w,2 | 13,21 |
| River Tern | *Sterna aurantia* | br,1 | 1 |
| Common Tern | *Sterna hirundo* | m,5 | 1 |
| Little Tern | *Sterna albifrons* | s,2 | 1 |
| Black-bellied Tern | *Sterna acuticauda* | br,1 | 1 |
| Whiskered Tern | *Chlidonias hybridus* | m,3 | 39 |
| **ACCIPITRIDAE** | | | |
| Osprey | *Pandion haliaetus* | w,2 | 1 |
| Black Baza | *Aviceda leuphotes* | s,4 | 9,13,19 |
| Oriental Honey-buzzard | *Pernis ptilorhyncus* | r,2 | 1 |
| Black-shouldered Kite | *Elanus caeruleus* | r,2 | 1 |
| Black Kite | *Milvus migrans* | r,2 | 1 |
| Brahminy kite | *Haliastur indus* | w,3 | 1 |
| Pallas's Fish Eagle | **Haliaeetus leucoryphus* | w,2 | 1 |
| White-tailed Eagle | *Haliaeetus albicilla* | w,2 | 1 |
| Grey-headed Fish Eagle | *Ichthyophaga ichthyaetus* | #r?,5 | 33 |
| Egyptian Vulture | *Neophron percnopterus* | r,4 | 1 |
| White-rumped Valture | **Gyps benghalensis* | br,1 | 1 |
| Long-billed Valture | **Gyps indicus* | r,2 | 1 |
| Himalayan Griffon | *Gyps himalayensis* | w,2 | 1 |
| Eurasian Griffon | *Gyps fulvus* | w,1 | 1 |

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|---|---|---|---|
| Cinereous Vulture | *Aegypius monachus* | w,2 | 1 |
| Red-headed Vulture | *Sarcogyps calvus* | w,3 | 1 |
| Short-toed Snake Eagle | *Circaetus gallicus* | w,3 | 1 |
| Crested Serpent Eagle | *Spilornis cheela* | r,2 | 1 |
| Eurasian Marsh Harrier | *Circus aeruginosus* | w,1 | 1 |
| Hen Harrier | *Circus cyaneus* | w,1 | 1 |
| Pallid Harrier | *Circus macrourus* | w,3 | 17 |
| Pied Harrier | *Circus melanoleucos* | w,2 | 1 |
| Montagu' Harrier | *Circus pygargs* | w,3 | 1 |
| Crested Goshawk | *Accipiter trivirgatus* | w?,3 | 13,21 |
| Shikra | *Accipiter badius* | r,2 | 1 |
| Besra | *Accipiter virgatus* | r,3 | 43 |
| Eurasian Sparrowhawk | *Accipiter nisus* | w,4 | 13,21 |
| Northern Goshawn | *Accipiter gentilis* | w,3 | 1 |
| White-eyed | *Butastur teesa* | r,2 | 1 |
| Common Buzzard | *Buteo buteo* | w,2 | 1 |
| Long-legged Buzzard | *Buteo rufinus* | w,3 | 1 |
| Black Eagle | *Ictinaetus malayensis* | w,5 | 1 |
| Lesser Spotted Eagle | *Aquila pomarina* | r,3 | 1 |
| Greated Sportted Eagle | **Aquila clanga* | w,2 | 13,21 |
| Tawny Eagle | *Aquila rapax* | r,4 | 1 |
| Steppe Eagle | *Aquila nipalensis* | w,1 | 1 |
| Imperial Eagle | **Aquila heliaca* | w,2 | 17 |
| Golden Eagle | *Aquila chrysaetos* | #w,5 | 33 |
| Booted Eagle | *Hieraaetus pennatus* | w,3 | 1 |
| Ruffous-bellied Eagle | *Hieraaetus kienerii* | m?,5 | 1 |
| Changeable Hawk Eagle | *Spizaetus cirrhatus* | r,s 1 | |
| Mountain Hawk Eagle | *Spizaetus nipalensi* | w,3 | 24 |

**FALCONIDAE**

| | | | |
|---|---|---|---|
| Collared Falconer | *Microhierax caerulescens* | r,3 | 1,10 |
| Lesser Kestrel | *Falco naumanni* | w,3 | 25,30,42 |
| Common Kestrel | *Falco tinnunculus* | w,1 | 1 |
| Red-necked Falcon | *Falco chicquera* | r,3 | 1 |
| Amur Falcon | *Falco amurensis* | w,3 | 6,13 |
| Merlin | *Falco columbarius* | m,4 | 25 |
| Eurasial Hobby | *Falco subbuteo* | m,4 | 1 |
| Oriental Hobby | *Falco severus* | s?,4 | 13 |
| Laggar Falcon | *Falco jugger* | m,5 | 4 |
| Peregrine Falcon | *Falco peregrinus* | w,3 | 1 |

**PODICIPEDIDAE**

| | | | |
|---|---|---|---|
| Little Grebe | *Tachybaptus ruficollis* | br,1 | 1 |
| Great Crested Grebe | *Podiceps cristatus* | w,2 | 13,21 |
| Black-necked Grebe | *Podiceps nigricollis* | #m,5 | 37 |
| **ANHINGIDAE** | | | |
| Oriental Darter | *Anhinga melanogaster* | br,2 | 1,12 |
| Phalacrocoracidae | | | |
| Little Cormorant | *Phalacrocorax niger* | br,1 | 1,5 |
| Greate Cormorant | *Phalacrocorax carbo* | w,2 | 1 |
| **ARDEIDAE** | | | |
| Little Egrer | *Egretta garzetta* | br,1 | 1,5 |
| Grey Heron | *Ardea cinerea* | br,2 | 1,12 |
| Perple Heron | *Ardea purpurea* | br,2 | 1,5 |
| Great Egret | *Casmerodius albus* | br,1 | 1,5 |
| Intermediate Egret | *meskophoyx intermedia* | br,1 | 1,5 |
| Cattle Egret | *Bublcus ibis* | br,1 | 1,12] |
| Indian Pond Heron | *Ardeola grayii* | br,1 | 1,12 |
| Little Heron | *Butorides striatus* | r,2 | 1 |
| Black-crowned Night Heron | *Nycticorax nycticorax* | br,1 | 1,5,12 |
| Yellow Bittern | *Ixobrychus sinensis* | br,2 | 1 |
| Cinnamon Bittern | *Ixobrychus cinnamomeus* | br,2 | 1 |
| Black Bittern | *Dupetor flavicollis* | r,s | 1 |
| Great Bittern | *Botaurus stellaris* | w,4 | 40 |
| Phoenicopteridae | | | |
| Greater Flamingo | *Phoenicopterus ruber* | #m,5 | 2,33 |
| **THRESKIORNITHIDAE** | | | |
| Glossy Ibis | *Plegadis falcinellus* | m,5 | 1 |
| Black-headed Ibis | *threskiornis melanocephalus* | r,2 | 1 |
| Black Ibis | *Pseudibis papillosa* | br,2 | 1 |
| Eurasian Spoonbill | *Platalea leucorodia* | w,2 | 17 |
| **PELECANIDAE** | | | |
| Great White Pelican | *Pelecanus onocrotalus* | m,4 | 4 |
| Spot-billed Pelican | **Pelecanus philippensis* | m,3 | 1 |
| **CICONIIDAE** | | | |
| Painted Strork | *Mycteria leucocephala* | s,3 | 1,3 |
| Asian Openbill | *Anastomus oscitans* | br,s | 1,12,34,38 |
| Black Stork | *Ciconia nigra* | w,2 | 1 |
| Woolly-necked Stork | *Ciconia episcopus* | r,2 | 1 |

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|---|---|---|---|
| White Stork | *Ciconia ciconia* | m,5 | 35 |
| Black-necked stork | *Ephippiorhynchus asiaticus* | br,2 | 1,37 |
| Lesser Adjutant | **Leptoptilos javanicus* | br,2 | 1 |
| Greater Adjutant | **Leptoptilos dubius* | s,4 | 10,17,41 |
| **PASSERIFORMES** | | | |
| Pittdae | | | |
| Hooded pitta | *Pita sordida* | s,5 | 10 |
| Indian Pitta | *Pitta brachyura* | s,5 | 1 |
| **IRENIDAE** | | | |
| Golden-fronted Leafbird | *Chloropsis aurifrons* | r?,4 | 13 |
| **LANIDAE** | | | |
| Rufous-tailde Shrike | *Lanius isabellinus* | m,4 | 29 |
| Brown Shrike | *Lanius cristatus* | w,1 | 1 |
| Bay-backed Shrike | *Lanius vittatus* | m,4 | 1 |
| Long-tailed Shrike | *Lanius schach* | br,1 | 1 |
| Grey-backed Shrike | *Lanius tephronotus* | w,2 | 13,21 |
| Southern Grey Shrike | *Lanius meridionalis* | r?,4 | 1 |
| **CORVIDAE** | | | |
| Red-billed Blue Magpie | *Urocissa erythrorhyncha* | r?,5 | 1 |
| Rufous Treepie | *Dendrocitta vagabunda* | br,1 | 1 |
| Gry Treepie | *Dendrocitta formosae* | w,4 | 37 |
| House Crow | *Corvus splendens* | br,1 | 1 |
| Large-billed Crow | *Corvus macrorhynchos* | br,1 | 1 |
| Ashy Woodswallow | *Artumus fuscus* | br,2 | 1 |
| Eurasian Golden Oriole | *Oriolus oriolus* | s,br,2 | 1 |
| Black-naped Oriole | *Oriolus chinensis* | w,5 | 13,21 |
| Slender-billed Oriole | *Oriolus tenuirostris* | w,4 | 21 |
| Black-hooded Oriole | *Oriolus xanthornus* | br,1 | 1 |
| Maroon Oriole | *Oriolus traillii* | w,5 | 40 |
| Large Cuckooshrike | *Coracina macei* | r,1 | 1 |
| Black-winged Cukooshrike | *Coracina melaschistos* | br,2 | 1,13,19 |
| Black-headed Cuckooshrike | *Coracina melanoptera* | s,4 | 1,23 |
| Rosy Miniver | *Pericrocotus roseus* | r,3 | 1 |
| Small Minivet | *Pericrocotus cinnamomeus* | r,2 | 1 |
| Scarlet Minivet | *Pericrocotus flammeus* | w,3 | 13 |
| Bar-Winged Flycatcher-strike | *Hemipus picatus* | r,3 | 13,21 |
| White-throated Fantail | *Rhipidura albicollis* | br,2 | 1 |
| White-browed Fantail | *Rhipidura aureola* | r,3 | 4 |

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|---|---|---|---|
| Black Drongo | *Dicrurus macrocercus* | br,1 | 1 |
| Ashy Drongo | *Dicrurus leucophaeus* | s,br,2 | 1 |
| White-bellied Drongo | *Dicrurus caerulescens* | r,3 | 1 |
| Crow-billed Drongo | *Dicrurus annectans* | s,4 | 1 |
| Bronzed drongo | *Dicrurus aeneus* | w,4 | 1 |
| Spangled Drongo | *Dicrurus hottentottus* | r,2 | 1 |
| Greater Racket-tailed Drongo | *Dicrurus paradiseus* | r,5 | 13 |
| Black-naped Monarch | *Hypothymis azurea* | s,3 | 1 |
| Asian Paradise-flycatcher | *terpsiphone paradisi* | s,2 | 1 |
| Common Iora | *Aegithina tiphia* | br,2 | 1 |
| Common woodshrike | *Tephrodornis pondicerianus* | r,3 | 13,20 |

**MUSCICAPIDAE**

| | | | |
|---|---|---|---|
| Blue-capped Rock Thrush | *Monticola cinclorynchus* | w,4 | 1 |
| Blue Rock Thrush | *Monticlo solitarius* | w,3 | 1 |
| Blue whistling Thrush | *Myophonus caeruleus* | w,3 | 1 |
| Orange-headed Thrush | *Zoothera citrina* | s,2 | 1 |
| Scaly Thrush | *Zoothera dauma* | w,2 | 1 |
| tickell's thrush | *Turdus unicolor* | w,4 | 1 |
| Black-breasted Thrush | *Turdus dissimilis* | v | 27 |
| White-collared Blackbird | *Turdus albocinctus* | w,5 | 41 |
| Grey-wingerd Blackbird | *Turdus boulboul* | w,3 | 13 |
| Eurasian Blackbird | *Turdus merula* | m,5 | 27 |
| Dark-throated Thrush | *Turdus ruficollis* | w,2 | 1 |
| Dusky Thrush | *Turdus naumanni* | w,4 | 2 |
| Dark-sided Flycatcher | *Muscicapa sibirica* | m,3 | 1 |
| Asian Brown Flycatcher | *Muscicapa dauurica* | m,3 | 1 |
| Rusty-tailed Flycatcher | *Muscicapa ruficauda* | m,5 | 24 |
| Slaty-backed Flycatcher | *Ficedula hodgsonii* | w,3 | 21 |
| red-throated Flycatcher | *Ficedula parva* | w,1 | 17 |
| Kashmir flycatcher | *Ficedula subrubra* | m,5 | 13 |
| Little pied Flycatcher | *Ficedula westermanni* | w,4 | 30 |
| Verditer Flycatcher | *Eumyias thalassina* | w,2 | 1 |
| pale-chinned Flycatcher | *Cyornis poliogenys* | r,4 | 13 |
| Blue-throated Flycatcher | *Cyornis rubeculoides* | w,5 | 1 |
| Pygmy Blue Flycatcher | *Muscicapella hodgsoni* | w,5 | 40 |
| Grey-headed Canary Flycatcher | *Culicicapa ceylonensis* | w,2 | 1 |
| Siberian Rubythroat | *Luscinia calliope* | w,1 | 1 |
| white-tailed rubythroat | *Luscinia pectoralis* | w,3 | 19 |
| Indian Blue Robin | *Luscinia brunnea* | m,5 | 29 |
| Bluethroat | *Luscinia svecica* | m,5 | 1 |
| Oriental Magpie robin | *Copsychus saularis* | br,1 | 1 |

| | | | |
|---|---|---|---|
| White-rumped Shama | *Copysychus malabaricus* | br,3 | 1 |
| Indian Robin | *Saxicoloides fulicata* | m,4 | 13,40 |
| Black Redstart | *Phoenicurus ochruros* | w,2 | 1 |
| White-capped water redstart | *Chaimarrornis leucocephalus* | #w,4 | 10,33 |
| Hodgson's Bushchat | **Saxicola insignis* | #w,4 | 1,18 |
| Common Stonechat | *Saxicola torquata* | w,1 | 1 |
| White-tailed Stonechat | *Saxicola leucara* | w,1 | 1 |
| Pied Bushchat | *Saxicola caprata* | br,2 | 1 |
| Jerdon's Bushchat | *Saxicola jerdoni* | #s?,5 | 18 |
| Grey Bushchat | *Saxicola ferrea* | w,4 | 1 |
| Brown Rock | *cercomela fusca* | #s,5 | 33 |
| **STUNIDAE** | | | |
| Spot-winged starling | *Saroglossa spiloptera* | w,4 | 21 |
| Chestnut-tailed starling | *Sturnus malabaricus* | br,2 | 1 |
| Brahminy Starling | *Sturnus Pagodarum* | br,4 | 1 |
| Rosy Starling | *Sturnus roseus* | m,4 | 27 |
| Common Starling | *Sturnus vulgaris* | m,3 | 13 |
| Asian Pied Starling | *Sturnus contra* | br,1 | 1 |
| Common Myna | *Acridotheres tristis* | br,1 | 1 |
| Bank Myna | *Acridotheres ginginianus* | br,2 | 1 |
| Jungle Myna | *Acridotheres fuscus* | br,1 | 1 |
| Hill Myna Gracula religiosa | w,3 | 13 | |
| **SITTIDAE** | | | |
| Chestnut-bellied Nuthatch | *Sitta castanea* | r?,4 | 30 |
| **PARIDAE** | | | |
| Great tit | *Parus major* | br,2 | 1 |
| **HIRUNDINIDAE** | | | |
| Sand Martin | *Riparia riparia* | w,4 | 1 |
| Plain Martin | *Riparia paludicola* | br,1 | 1 |
| Barn Swallow | *Hirundo rustica* | w,1 | 1 |
| Wire-tailed Swallow | *Hirundo smithii* | w?,5 | 28 |
| Red-rumped Swallow | *Hirundo daurica* | r,1 | 1 |
| Streak-throated Swallow | *Hirundo fluvicola* | s,4 | 33 |
| **PYCNONOTIDAE** | | | |
| Black-crested Bulbul | *Pycnonotus melanicterus* | w,4 | 21 |
| Red-Whishkered Bulbul | *Pycnonotus jocosus* | br,2 | 1 |
| Red-vented Bulbul | *Phycnonotus cafer br,2* | 1 | |

**CISTICOLIDAE**

| | | | |
|---|---|---|---|
| Zitting Cisticola | *Cisticola juncidis* | br,1 | 1 |
| Bright-caped Cisticola | *Cisticola exilis* | br,2 | 1 |
| Striated Prinia | *Prinia criniger* | w?,5 | 31 |
| Grey-crowned Prinia | **Prinia crinereocapilla* | r?,5 | 1 |
| Grey-breasted Prinia | *Prinia hodgsonii* | r,3 | 1 |
| Greaceful Prinia | *Prinia gracilis* | r,3 | 1 |
| Yellow-bellied prinia | *Prinia flaviventris* | br,2 | 1 |
| Ashy Prinia | *prinia socialis* | r?,4 | 1 |
| Plain Prinia | *Prinia inornata* | br,2 | 1 |

**ZOSTEROPIDAE**

| | | | |
|---|---|---|---|
| Oriental White-eye | *Zosterops Palpebrosus* | r,2 | 1 |

**SYLVIIDAE**

| | | | |
|---|---|---|---|
| Pale-footed Bush Warbler | *Cettia pallidipes* | w,r?4 | 1,7,43 |
| Chestnut-crowned Bush Warbler | *Cettia major* | w,3 | 1 |
| Aberrant Bush Warbler | *Cettia flavolivacea* | w,3 | 13 |
| Grey-sided Bush Warbler | *Cettia brunnifrons* | w,3 | 33 |
| Spotted Bush Warbler | *Bradypterus thoracicus* | w,3 | 21,33 |
| Chinese Bush Warbler | *Bradypterus taczanowskius* | w?,5 | 13,33 |
| Lanceolated Warbler | *Locustella lanceolata* | #m,5 | 33 |
| grasshopper Warbler | *Locustella naevia* | #m,5 | 33 |
| Black-browed Reed Warbler | *Acrocephalus bistrigiceps* | w,4 | 13,33 |
| Paddyfield warbler | *Acrocephalus agricola* | w,3 | 1 |
| Bluent-winged Warbler | *Acrocephalus concinens* | w,3 | 6 |
| Blyth's Red Wardler | *Acrocephalus dumetorum* | w,1 | 1 |
| Clamorous Reed Warbler | *Acrocephalus stentoreus* | w,2 | 1 |
| thick-billed Warbler | *Acrocephalus aedon* | w,2 | 1 |
| Booted Warbler | *Hippolais caligata* | w,3 | 33 |
| Common Tailorbird | *Orthotomus sutorius* | br,1 | 1 |
| Common Chiffchaff | *Phylloscopus collybita* | w,2 | ? |
| Dusky Warbler | *phylloscopus fuscatus* | w,1 | 1 |
| Smoky Warbler | *Phylloscopus fuligiventer* | w,2 | 1 |
| tickell's Leaf Warbler | *Phylloscopus affinis* | w,2 | 1 |
| Sulphur-bellied warbler | *Phylloscopus griseolus* | m,4 | 1 |
| Hume's Warbler | *Phylloscopus humei* | w,2 | 1 |
| Greenish Warbler | *Phylloscopus trochiloides* | w,1 | 1 |
| large-billed leaf warbler | *phylloscopus magnirostris* | m,4 | 1 |
| western crowned wabler | *phylloscopus occipitalis* | m,4 | 33 |
| Blyth,s Leaf Warbler | *Phylloscopus reguloides* | w,3 | 1 |

| | | | |
|---|---|---|---|
| Yellow-vented Warbler | *Phylloscopus cantator* | w,5 | 41 |
| Golden-spectacled Warbler | *Seicercus burkii* | w,2 | 1 |
| striated Grassbird | *Megalurus palustris* | br,2 | 1 |
| Bristled Grassbird | **Chaetornis striatus* | s,br,2 | 13 |
| Abbott's Babbler | *Malacocincla abbotti* | r?,5 | 1 |
| Striped Tit Babbler | *Malacocincla gularis* | r?,5 | 22 |
| Striped Babbler | *Turdoides earlei* | br,2 | 1 |
| Jungle Babbler | *Turdoides Striatus* | br,1 | 1 |
| Lesser Whitethroat | *Sylvia curruca* | m,4 | 37,39 |
| Orphean Warbler | *Sylvia hortensis* | m,5 | 18,33 |
| **ALAUDIDAE** | | | |
| Rufous -winged Lark | *Mirafra assamica* | br,2 | 1 |
| Ashy-crowened Sparrow Lark | *Eremopterix grisea* | br,2 | 1 |
| Greater Short-toed Lark | *Calandrella brachydactyla* | w,3 | 1 |
| Hume's Short -toed Lark | *Calandrella acutirostris* | # w,4 | 33 |
| Sand Lark | *Calandrella raytal* | br,1 | 1 |
| Crested Lark | *Galerida cristata* | r,3 | 1 |
| Oriental Skylark | *Alauda gulgula* | r,3 | 1 |
| **NECTARINIIDAE** | | | |
| Thick-billed Flowerpecker | *Dicaeum agile* | r,4 | 13 |
| Pale-billed Flowerpecker | *Dicaeum erythrorynchos* | r,4 | 1 |
| Purple Sunbird | *Nectarinia asiatica* | br,2 | 1 |
| **PASSERIDAE** | | | |
| House Sparrow | *Passer domesticus* | br,1 | 1 |
| Spanish Sparrow | *Passer hispaniolensis* | #m,4 | 33 |
| eurasian Tree Sparrow | *Passer montanus* | w,4 | 1 |
| chestnut-Shouldered Petronia | *Pertonia xanthocollis* | r,3 | 1 |
| Forest Wagtail | *Dendronanthus indicus* | w,4 | 11 |
| White Wagtail | *Motacilla alba* | w,1 | 1 |
| white-browed Wagtail | *Motacilla maderspatensis* | br,2 | 1 |
| Citrine wagtail | *Motacilla citreola* | w,1 | 1 |
| Yellow wagtail | *Motacilla flava* | w,2 | 1 |
| Grey wagtail | *Motacilla cinerea* | w,3 | 1 |
| Richard's Pipit | *Anthus richardi* | w,2 | 1 |
| Paddyfield Pipit | *Anthus rufulus* | br,1 | 1 |
| Tawny Pipit | *Anthus campestris* | w,4 | 21 |
| Blyth's Pipit | *Anthus godlewskii* | w,4 | 21 |
| Long-billed Pipit | *Anthus similis* | m,5 | 6 |
| Tree Pipit | *Anthus trivialis* | w,4 | 1 |

| | | | |
|---|---|---|---|
| Olive-backed Pipit | *Anthus hodgsoni* | w,2 | 1 |
| Red-throated Pipit | *Anthus cervinus* | w,3 | 21 |
| Rosy Pipit | *Anthus roseatus* | w,2 | 1 |
| Water Pipit | *Anthus spinoletta* | m,3 | 13 |
| Buff-bellied Pipit | *Anthus rubescens* | m,3 | 44 |
| Black-breasted Weaver | *Ploceus benghalensis* | br,3 | 1 |
| Streaked Weaver | *Ploceus manyar* | r,4 | 13 |
| Baya Weaver | *Ploceus philippinus* | br,2 | 1 |
| Red Avadavat | *Amandava amandava* | br,2 | 1 |
| Indian silverbill | *Lonchura malabarica* | r,4 | 1 |
| White-rumped Munia Lonchura striata | | *Lonchura striata* | 1 |
| Scaly-breasted Munia | *Lonchura Punctulata* | br,1 | 1 |
| black-headed Munia | *Lonchura malacca* | br,3 | 1 |

**FRINGILLIDAE**

| | | | |
|---|---|---|---|
| Common Rosefinch | *Carpodacus erythrinus* | w,3 | 4 |
| Crested Bunting | *Melophus lathami* | w,3 | 1 |
| Chestnut-eared Bunting | *Emberiza fucata* | w,4 | 1 |
| Little Bunting | *Emberiza pusilla* | w,4 | 4,40 |
| Yellow-breasted Bunting | *Emberiza aureola* | w,1 | 1 |
| Black-headed Bunting | *Emberiza melanocephala* | w,3 | 37 |
| Black-faced Bunting | *Emberiza spodocephala* | w,2 | 1 |
| pallas's Bunting | *Emberiza Pallasi* | w,5 | 32 |

**Key to the codes:**

globally threatened

1 common, >75% chance

2 fairly common, >50% chance

3 occasional,>25% chance

3 rare, 5% chance

4 less than 5 records at Koshi

# recorded at Koshi Barrage only

r resident, seen all the year round

s summer visitor

w winter visitor

m passage migrant

v vagrant

br breeding confirmed

Source: IUCN, Baral, 2000 and

Hari Thapaliya 1999-2001

# APPENDIX –7

## Koshi tappu wildlife Reserve
## Fishes Checklist

| S.No. Family | Local & Common Name | Scientific Name | A | B | C |
|---|---|---|---|---|---|
| 1. Clupeidae | Suiya(River Shad) | *Gudusia chapra* | R | | |
| | Suhya (Bumese River Shad) | *Gudusia godanahiae* | R | | |
| | Phasi, Gankabai ( Gangetic Hairfin Anchvy) | *Setipinna phasa* | R | | |
| 2. Notopteridae | Mohi, Chital (Humped Featherback) | *Notopterus chitala* | R | | |
| | Golhi, Patara ( Grey Featherback) | *Notopterus notopterus* | L | | |
| 3. Cyprinidae | Katle | *Acrossocheilus hexagonolepis* | L | | V |
| | Catla, Bhakur | *Catla catla* | L | | |
| | Rewa, Chaguni | *Chagunius chagunio* | R | | V |
| | Naini, Mrigal | *Cirrhinus mrigala* | R | | |
| | Rewa | *Cirrhinus repa* | R | | |
| | Thed ( Angra Labeo) | *Labeo angra* | L | | |
| | Rohu ( Bata Labeo) | *Labeo bata* | R | | |
| | Boga | *Labeo boga* | R | | |
| | Kalbasu ( Black Rohu) | *Labeo calbasu* | R | | |
| | Roi ( Sina Labeo) | *Labeo caeruieus* | R | | |
| | Gerai, Kaiapans | *Labeo dero* | L | | |
| | Kalanch ( Branmaputra Labeo) | *Ladeo dyocheilus* | R | | |
| | Kurs, Gurci | *Labeo gonius* | R | | |
| | Termassa | *Labeo pangusia* | R | | |
| | Rohu | *Labeo rohita* | R | | |
| | Rohu | *Labeo sindensis* | R | | |
| | Gurpa | *Osteoprama cotio* | R | | |
| | Sidre | *Puntius apogon* | R | | |
| | Karange | *Puntius chilinoides* | R | | |
| | Siare, (Pwamp Baro) | *Puntius cnoia* | R | | |
| | Baca Potnia (stedman Baro) | *Puntius clavatus* | R | | |
| | Pothia Siare (Rosy Baro) | *Puntius gelices* | R | | |
| | Sidre ( Fire fin Baro) | *Puntius ticto* | R | | |
| | Manaseer | *Tor putitora* | M | | \ |
| | Sahar | *Tor tor* | M | | I |
| | Dhawai | *Amplypmaryngodon mola* | R | | |

| | | | | |
|---|---|---|---|---|
| | Mara | *Aspidoparia jaya* | R | |
| | Bhegna | *Aspidoparia morar* | R | |
| | Chacnale | *Barilius barila* | R | |
| | Fakata | *Barilius barna* | R | |
| | Jalkapoor | *Barilius jaikapoorei* | L | |
| | Gudasi | *Barilius cendetisis* | L | |
| | Trout | *Barilius bola* | R | V |
| | Tileobarit | *Barilius tileo* | L | |
| | Vagra bant | *Barilius vagra* | L | |
| | Bhitti | *Danio aequipinnatus* | R | |
| | Nepti | *Danio dangila* | R | |
| | Chitanari pothi | *Danio devano* | R | |
| | Zebra fish | *Danio rerio* | R | V |
| | Dhedawa | *Esomus danricus* | R | |
| | Dedua | *Raspora daniconius* | R | |
| | Silver Hatchet Chela | *Chela cachius* | R | |
| | Dewuwa, Chelwa ( Glass Baro) | *Chela laubuca* | R | |
| | Namsehara ( Razor Belly Minnow) | *Oxygaster argentea* | R | |
| | Darai ( Large Razor Belly Minnow) | *Oxygaster bacaile* | R | |
| | Chaiwa | *Oxyaster gora* | R | |
| | Finescale Razor Belly Minnor | *Oxyaster Phuio* | R | |
| | Dhuria ( Gangetic Latius) | *Chrossocheilus latius* | R | |
| | Buauna, Lonar | *Garra annangale* | R | |
| | Buoune | *Garra lamta* | R | V |
| 4. Cobitidae | Bahni | *Botia nistnonica* | R | |
| | Loach | *Botia tonachate* | R | |
| | Lata Nakata Goira ( Guntes Oach) | *Lebiaccephalichtnys guntea* | R | |
| | Latai ( Gongota Loch) | *Somileptes gongota* | R | |
| | Nawa Bhoti Pate Gadela | *Noemacheilus potle* | R | |
| | Gapera Garolia | *Noemacheilus aevaevi* | R | |
| 5 Amblycioidae | Pichhi | *Ambiyceps mangois* | R | |
| 6 Bagridae | Kanti ( Long Whiskered Carits | *Mystus aor* | R | |
| | Tengra ( Day's Mystus) | *Mystus bleeker* | R | |
| | Tebgra ( Gangetic Mystus) | *Mystus cavasius* | R | |
| | Tengra ( Giant River Catish) | *Mystus seengnate* | R | |
| | Tenari ( Tengara Mystus) | *Mystus tengara* | R | |
| | Tengri ( Stnped Dwart Carits) | *Mystus vittatus* | R | |
| | Rita Chona | *Rita rita* | R | V |
| 7. Siluridae | Pabata ( Butter Carfish) | *Ombok bimaculatus* | R | |
| | Pabata | *Ombok pabo* | R | |

| | | | |
|---|---|---|---|
| | Bunari pagani | *Waliago attu* | R |
| 8. Scnibeidae | Paras, Patangu (Gangetic) | *Allia coita* | R |
| | Jakapoc, ( Garua Bachhwa) | *Clupisoma garua* | R |
| | Jakapoor ( Kocne Gara) | *Clupisoma montana* | R |
| | Eaconora Bachawa ( Goongwaree Vacna) | *Eutrobichhnys vacna* | R |
| | Jalkapoor Patas, Potas | *Pseudeutropius athennoids* | R |
| 9. Sisoridae | Gounch ( Gangetic Gounct) | *Bagarius bagarius* | R |
| | Tiktni (gogta Gagata) | *Gagata centa* | R |
| | Gogta | *Gagata nangra* | R |
| | Kapre | *Glyptothorax horai* | R |
| | Kotel Telchtta Telcapre | *Glyptothorax telchitta* | R |
| | Sylhet Hara | *Hara jerdoni* | R |
| | Huadah Nanger | *Nangra viridescens* | R |
| | Kabri (Sulcatrs Catfish) | *Pesuoecheneis sulcatus* | R |
| | Bisturyaa ( Sisor Cafish) | *Sisor mabdophorus* | R |
| 10. Chacidae | Pauna, Pauwa | *Chaca chaca* | R |
| 11. Saccobranchidae | Sighi ( Stinging Catfish | *Heteropneustes fossilis* | R |
| 12. Claridae | Mungi, Mangur | *Clanas batrachus* | R |
| 13 Anguillidae | Rajabam ( Longfin Freshwater El) | *Anguilla bengalensis* | R |
| 14 Belonidae | Kauwa, Chuchhe Bam (Fresh water Garfish) | | |
| | *Xenentodon cancila* | R | |
| 15 Channadae | Bhoti, Hile ( Asiatic Murrel) | *Channa gachua* | R |
| | Saul, Saura ( Giant Murrel) | *Channa marulius* | R |
| | Garahi ( Spotted Murrte) | *Chnna punctatus* | R |
| | Hite ( Assamese Murrel) | *Channa stewartii* | R |
| | Saura (Striped Murrel) | *Channa striatus* | R |
| 16 Amphinoidae | Bam ( Gangetic Muddeel) | *Amphiphous cuchia* | R |
| 17 Chandidae | Nata ( Elongated Glass-perchie) | *Chanda nama* | R |
| | Chanari(Glassy Fish) | *Chanda ranga* | R |
| 18 Sciaenidae | Bnola(Two-bearded Croaker) | *Sciaena coitor* | R |
| 19 Nandidae | Pasari(Dwarf Chameleon fish) | *Badis badis* | R |
| | Dhala(Mottled Nandus) | *Nandus nandus* | R |
| 20. Anabantidae | Kabai ( Climbing Prch) | *Anabas testudineus* | R |
| 21 Belontidae | katara (Stripped Gourami) | Colisa *fasciatus* | R |
| | Dwari Gourami | *Colisa latius* | R |
| | Gourami | *Colisa sota* | R |
| 22. Gobiidae | Bulla (Tank Goby) | *Glossogobius giuns* | R |
| 23. Mastacembelidae | Gainchi | *Macrognathus aculeatus* | R |
| | Gainchi | *Macrognathus aral* | R |
| | Chusi Bam | *Mastacembelus armatus* | R |

| | | | | |
|---|---|---|---|---|
| | Kath Gainchi | *Mastacembelus pancalus* | R | |
| 24 Tetrodontidae | Pokcha (Ocellated Pufferfish) | *Tetraodon cutcutia* | R | V |

Column A= Movement status Column B=National Red data list, 1995

Column C=check and remarks

Legend E= Endangered; L= Local Migratory M= Migratory,

R= Resident, V= Vulnerable

Source: IUCN,

Hari Thapaliya 1999- 2001

# APPENDIX –8

## Koshi tappu wildlife Reserve
## Amphibians and Reptiles Checklist

| S. No. | Family | Common Name | Scientific Name | A | B | C | D |
|---|---|---|---|---|---|---|---|
| 1 | Butonidae | black-spined toad | *Bufo melanostictus* | | | | |
| 2 | | marbled Toad | *Bufo stomaticus* | | | | |
| 3 | Ranidae | | *Amolops afghanus* | | | | |
| 4 | | | *Rana crassa* | | | | |
| 5 | | water skipper skittering frog | *Rana cyanophlyctis* | | | | |
| 6 | | | *Rana humeralis* | | | | |
| 7 | | | *Rana limnochans* | | | | |
| 8 | | | *Rana nigriventtata* | | | | |
| 9 | | indian bull frog | *Rana tigrina* | | | | |
| 10 | | indian burrowing frog | *Tomopterna breviceps* | | | | |
| 11 | Rnacophoridae | tree frog | *Polypedatus* spp. | | | | |
| 12 | Crocodylidae | marsh mugger | *Crocodylus palustris* | V | V | | |
| 13 | | gharial | *Gavialis gangeticus* | E | E | | |
| 14 | Emydidae | painted roofed turtle | *Kachuga kachuga* | V | I | | |
| 15 | | brown rooted turtle | *Kachuga smithii* | S | | | |
| 16 | | indian roofed turtle | *Kachuga tecta* | S | | | |
| 17 | | branminy river turtle | *Hardella thurgli* | S | | | |
| 18 | | peninsular black turtle | *Melanocnelys trijuga* | S | | | |
| 19 | Testudinidae | elongated tortoise | *Inaotestudo elongate* | S | K | | |
| 20 | Trionychidae | chitra turtle | *Chitra indica* | S | | | |
| 21 | | indo-gangetic soft-shell turtle | *Lissemys punctata* | S | | | |
| 22 | | ganges soft-shell turtle | *Aspideretes gangeticus* | V | | | |
| 23 | | peacocksoft -snell turtlel | *Aspideretes nuruM* | S | | | |
| 24 | | leith's soft-snell turtle | *Aspideretes leithi* | S | | | |
| 25 | Agamidae | garden lizards | *Calotes versicoto'* | | | | |
| 26 | Gekkonidae | saffron-pellled wall geoxo | *Hemidactylus flaviviridis* | | | | |
| 27 | | bridied house gecko | *Hemidactylus frenatus'* | | | | |
| 28 | Scincidae | dotted garden skink | *Riopa punctata* | | | | |
| 29 | Varanidae | golden monitor | *Varanus flavescens'* | | | | |
| 30 | bengal monitor | | *Varanus bengalensis* | | S | | |
| 31 | Typhlopidae | Blind Snake | *Rhamphotyphlops braminus* | S | | | |
| 32 | Boidae | Indian Rock Python | *Ptyas mucosus* | | S | | |

| | | | | |
|---|---|---|---|---|
| 33 | Colubridae | short-nosed vine snake | *Anaetulia nasuta* | |
| 34 | | buff-striped keelback | *Amphiesma stolats* | |
| 35 | | common cat snake | *Bioga trigonata* | |
| 36 | | smooth water snake | *Enhydris enhydris* | |
| 37 | | Asian rat snake | *Python molurus* | |
| 38 | | checkered keelback | *Xenochrophis piscator* | S |
| 39 | | checkered keelback | *Xenochrophis sanctijohannis* | |
| 40 | Elapidae | banded krait | *Bungarus fasciatus* | |
| 41 | | commonkrait | *Bungarus caerulus* | |
| 42 | | king cobra | *Ophiophagus hannah* | V |
| 43 | | monocellate cobra | *Naja naja kauthia* | |
| 44 | | bio0ncellate cobra | *Naja naja naja* | |
| 45 | Viperidae | green pit viper | *Trimeresurus gramineus* | |

Column A=national red data list column B=IUCN red data list 1994

Column C=CITES list1994 column D=check and remarks

Legend: E=endangerned; I=intermediate;

K=insuffciently known; S=susceptible;

V=vulnerable;

Source IUCN,

Hari Thapaliya 1999- 2001 (Field Survey)

# APPENDIX –9

## Koshi tappu wildlife Reserve
## Butterflies Checklist

| *Scientific Name* | *Common Name* |
|---|---|
| **FAMILY:PAPILLIONIDAE** | |
| *Papilio polytes romoius* | Common Marmom |
| *Achillides (Papilio) polyctor ganesa* | Common Peacock |
| *Papilio demoleus demoleus* | Lime Swallowtail |
| *Papilio macaon emihpocrates* | Common Yellow |
| **FAMILY: PIERIDAE** | |
| *Catopsilia pyranthe pyranthe* | Mottled Emigrants |
| *Catopsilia pomana poman* | Lemon Emigrants |
| *Gonepteryx rhamni nepalensis* | Common Brimstone |
| *Catophaga* (Appias ) *lyncida eleonara* | Chocolate Albatross |
| *Eurema hecabe contubemalls* | Common Grass yellow |
| *Eurema brigitta* | Small Grass Yellow |
| *Anaemorona descombesi leucacantha* | Red Soot Jezebei |
| *Cathaemia hyparete* | Painted Jezebei |
| *Delias acalis pyramus* | Red breast Jezebei |
| *Delias pasithoe thyra* | Red base Jezebei |
| *Cebora nerissa* | Common Gull |
| *Pareronia valeria nippa* | Common Wanderer |
| **FAMILY: LYCAENIDAE** | |
| *Celastrina puspa* | Common Hedgeblue |
| *Zizeena maha maha* | Pale Grassblue |
| *Freyena butil* | Least Grass Jewel |
| *Castalius rosimon rosimon* | Common Pierrot |
| *Careta careta decidia* | Angled Pierrot |
| *Jamides celeno aelianus* | Common Cerullean |
| *Lampides boeticus* | Peablue |
| *Zizina otis otis* | Lesser Grassblue |
| **FAMILY: NYMPHALIDAE** | |
| *Precis femonias persicaria* | Lemon Pansy |
| *Precis almana almana* | Peacock Pansy |
| *Precis atlites atlites* | Gray Pansy |

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|---|---|
| *Precis onthya ocyale* | Blue Pansy |
| *Precis iphita* | Chocolate Pansy |
| *Precis hierta hierta* | Yellow Pansy |
| *Neptis hylas kamarupa* | Common sailo |
| *Athyma penus* | Common Sergeant |
| *Athyma opalina orientalis* | Himalayan Sergiani |
| *Phalanta phalanta* | Common Leopard |
| *Hypolymnas bolina jacintha* | Great Eggfly |
| *Vagrens egista* | Vagrant |
| *Ariadne merione* | Common Castor |

**FAMILY: SATYRIDE**

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|---|---|
| *Melanitis leda leda* | Common Evening Brown |
| *Mycalesis persius persius* | Common Bushbrown |
| *Orsotrioena medus medus* | Jungle Brown |

**FAMILY: DANAIDAE**

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|---|---|
| *Euploea core core* | Common Indian crow |
| *Euploea klugi kollari* | King crow |
| *Danaus genutia* | Common Tiger |
| *Danaus chryssipus* | Plain Tiger |
| *Danaus aglea melanoides* | Glassy Tiger |

**FAMILY: HESPRIDAE**

| | |
|---|---|
| *Pelopidas sinesis* | Large Brandeo Swift |
| *Pelopidas mathias mathias* | Small Brandeo Swift |
| *Borvo bevani* | Bevans Swift |
| *Spialla galpa* | Indian Skipper |
| *Tagiades litigosa* | Water Snow Flat |
| *Pamara guttata* | Straight Swift |
| *Potanthus pseudomaesa cho* | Common Indian Dan |

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Source: IUCN,
Hari Thapaliya 1999- 2001